

Causal Relationships between Media Use and Information Literacy^[1]

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Abstract: In order to examine if use of media (Internet, radios, TVs, or video games) improves information literacy for individuals, a three-wave panel study with junior high school students was conducted at half-year intervals. The analysis of causal relationships between Internet use and the skill to practically use information indicated virtually no short-term effect. When these results were closely examined for each type of Internet tool, however, there was a long-term effect that Internet use at the first survey did improve the skill to practically use the information and its sub-skills at the third survey. These results suggested that the effect of Internet use to improve the skill to practically use information and its sub-skills would become observable after a certain, longer period of time following the Internet use. This study indicated virtually no significant effects for other types of media.

Introduction

As indicated by the fact that the number of Internet users has been growing, societies are recently undergoing rapid computerization. In order for children to survive in such advanced information societies, it is believed that they must acquire so-called information literacy defined by the abilities to obtain correct knowledge on given information and to effectively use such information. In Japan, in 1998 the Education Ministry defined the ability equivalent to information literacy as the “skill to practically use information,” and requested educational institutions to develop this skill. The skill to practically use information here is the “ability to proactively collect, judge, express, process, and create information, as well as the ability to communicate information while taking the status of information recipients into consideration, and the abilities listed above necessarily include the ability to appropriately use tools for communicating information depending on assignments or purposes.” In response to the requests from the Education Ministry, educators and educational institutions are now searching for ways of effective information education while actively implementing Internet use.

Does Internet use improve information literacy? To find out, some studies have been conducted so far to examine the influence of the amount of Internet use on the skill to practically use information. Among the previous studies, the result of a quasi-experiment by Naito (03) for example indicated that Internet use by children during classes improved the total scores for the skill to practically use information as well as its sub-skills, such as the abilities to collect, judge, process, and communicate information. However, findings from non-classroom situations do not agree among various study results (e.g., Mouri, Sakamoto, Hatano, & Sakamoto (02); Takahira et al. (02)).

Review of such study results implies that the effect of Internet use outside classes on the skill to practically use information is not clear, and it is believed that more research is necessary. Thus, in this study, a three-wave panel study with junior high school students was conducted to examine in further detail the causal relationship between the amount of Internet use outside classes and the skill to practically use information. A panel study in general refers to a survey study conducted with a single group of subjects in which the same variables are measured twice or more,

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and the analysis result of such obtained data clarifies causal relationships between variables. The effect of the amount of radio use, TV use, and video game use on the skill to practically use information was also analyzed, and differences in effects by type of media was discussed.

Although two-wave panel studies to examine the influence of the amount of Internet use on the skill to practically use information have been conducted (Mouri et al. 02; Takahira et al., 02), no three-wave panel studies had been conducted to measure at three different times the amount of Internet use and the skill of practically use information. Execution of a three-wave panel study is considered meaningful for the two reasons below:

First, for the influence of Internet use on the skill to practically use information, the estimated causal relationship based on the result of a three-wave panel study should be more reliable than that of a two-wave panel study. Second, a three-wave panel study allows simultaneous measurements of: short-term causal relationships between the first and second surveys as well as between the second and the third surveys; and a long-term causal relationship between the first and the third survey. This will then allow comparison between short-term and long-term causal relationships. Also, if both short-term and long-term effects of Internet use are indicated, it can be pointed out that accumulation of short-term effects may result in the long-term effect. As seen above, a three-wave panel study not only integrates the findings of the previous two-wave panel studies but also allows examination of the long-term effect of the amount of Internet use, and it will thus provide great value.

Method

Subject schools and students

With 5 junior high schools in 0 city, surveys were conducted three times (first survey: October 1998, second survey: March 1999, third survey September, 1999). Data obtained from 539 (290 males and 249 females) junior high school students who participated in all three of the surveys was later analyzed.

Survey questions

Skill to practically use information In this study, the “Skill for Practical Use of Information Scale” by Takahira et al. (01) was used. This scale is compliant with the Education Ministry’s definition of information literacy and was designed to measure 6 sub-skills constituting the skill to practically use information. Specifically, this scale measures the following sub-skills: (1) the ability to collect information; (2) the ability to judge information; (3) the ability to express information; (4) the ability to process information; (5) the ability to create information; and (6) the ability to communicate information. (Takahira et al. (01) and Naito et al. (03) showed detailed definitions of each sub-skill.)

Based on the measurements, total scores are calculated and treated as indices of the ability to practically use information. The survey contained 10 questions regarding the ability to collect information, 8 questions regarding the abilities to judge information, express information, and process information, respectively, and 10 questions regarding the abilities to create information and communicate information, respectively. For each question, the subjects were asked to answer by using a 7-point scale.

Amount of Internet use For the amount of Internet use outside classes (e.g. at home) per day, the subjects were asked to use a 6-point scale, comprising choices of “none,” “less than 5 minutes,” “5 minutes to less than 15 minutes,” “15 minutes to less than 30 minutes,” “30 minutes to less than 1 hour,” and “more than 1 hour,” to answer: (a) the total time spent on using the Internet regardless of how it is used; (2) time spent on using e-mail; (c) time spent on Web-site viewing; and (d) time spent on Web-page creation.

Amount of use of other types of media For the amount of radio, TV (including video), and video game uses per day at school and home, the subjects were asked to answer with a 5-point scale, comprising choices of “none,” “less than 30 minutes,” “30 minutes to less than 1 hour,” “1 hour to less than 1 hour and half,” and “more than 2 hours.”

Demographic variables The subjects were asked to provide their school name, grade, and gender.

Procedure

Surveys were administered simultaneously to subject classes, and the questionnaires were collected on the spot.

Result

Table 1 shows mean values and standard deviations of the skill to practically use information, its 6 sub-skills, and the amount of media use measured with each survey.

Table1. The means and SDs of the skill to practically use information, its sub-skills and the amounts of media

	first		second		third	
	range	mean(SD)	range	mean(SD)	range	mean(SD)
The skill to practically use information						
Total score	102~ 329	220.64(30.97)	118~ 329	220.37(30.88)	105~ 349	222.25(29.22)
Collecting	14~ 68	42.92(7.35)	22~ 70	43.00(7.34)	21~ 68	44.05(7.18)
Judging	16~ 48	31.00(5.42)	12~ 56	30.83(6.02)	12~ 54	31.32(5.91)
Expressing	8~ 53	31.23(6.43)	8~ 51	31.48(6.26)	11~ 54	31.65(6.26)
Processing	8~ 50	30.75(6.29)	9~ 52	30.68(6.62)	8~ 56	30.67(6.47)
Creating	18~ 67	41.67(7.42)	19~ 70	41.85(7.80)	22~ 68	41.78(6.65)
Communicating	17~ 63	43.03(7.44)	20~ 63	42.18(7.04)	15~ 64	42.51(6.89)
Amount of Internet use						
Total time spent on Internet use	1~ 6	1.16(0.71)	1~ 6	1.26(0.90)	1~ 6	1.37(1.07)
Time spent on e-mail use	1~ 6	1.09(0.49)	1~ 5	1.12(0.55)	1~ 6	1.18(0.73)
Time spent on Web-site viewing	1~ 6	1.15(0.67)	1~ 6	1.23(0.81)	1~ 6	1.27(0.89)
Time spent on Web-page creation	1~ 6	1.05(0.39)	1~ 5	1.02(0.24)	1~ 5	1.03(0.32)
Amount of use of other types of media						
Amount of radio use	1~ 6	1.84(1.32)	1~ 6	1.89(1.36)	1~ 6	1.89(1.39)
Amount of TV use	1~ 6	4.69(1.25)	1~ 6	4.78(1.28)	1~ 6	4.49(1.30)
Amount of video game use	1~ 6	2.22(1.52)	1~ 6	2.27(1.56)	1~ 6	2.04(1.43)

Examination of analysis models

Analyses using the structural equation model were conducted in order to examine the causal relationship between the skill to practically use information and the use of media such as the Internet. For the analyses, the cross-lagged effect model as shown in Figure 1 was used. In this model, we would suspect that there existed a causal relationship in which the use of media improved the skill to practically use information if the path from the amount of media use measured at the first survey to the skill to practically use information (Path (1) in Figure 1) and the path from the amount of media use measured at the second survey to the skill to practically use information (Path (2) in Figure 1) were both positive and significant. At the same time, we would suspect that there existed a reversed causal relationship in which high skill to practically use information caused a large volume of media use if the path from the skill to practically use information measured at the first survey to the amount of media use measured at the second survey (Path (3) in Figure 1) and the path from the skill to practically use information measured at the second survey to the amount of media use measured at the third survey (Path (4) in Figure 1) were both positive and significant. Furthermore, examination of a path from the amount of media use (or the skill to practically use information) measured at the first survey to the skill to practically use information (or the amount of media use) measured at the third survey would allow estimation of long-term causal relationships.

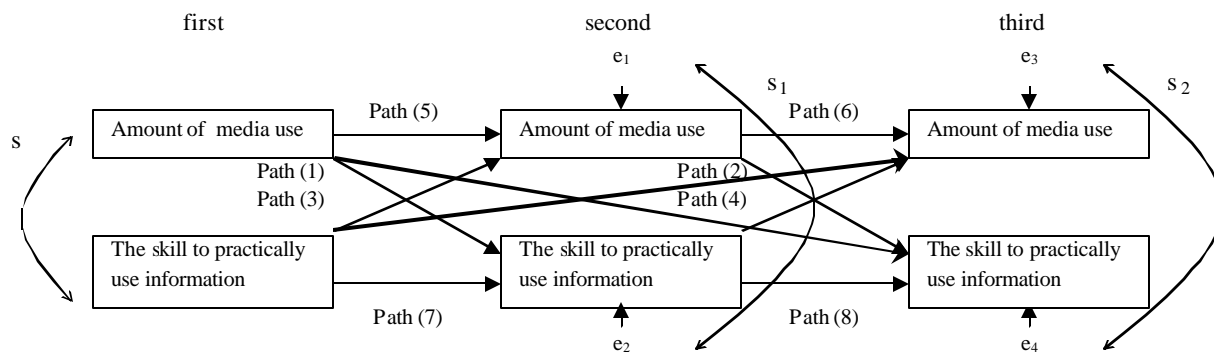


Figure 1. Cross-lagged effect model

Before analyzing the causal relationships, model constraints were examined. First, goodness of fit of: a constraint model in which Path (1) and Path (2) had an equal effect; a constraint model in which Path (3) and Path (4) had an equal effect; a constraint model in which Path (5) and Path (6) had an equal effect; and a constraint model in which Path (7) and Path (8) had an equal effect was compared with that of 4 counterparts with unrestricted paths. After choosing the fittest model, constraints for the covariance (s_1) of an error in the amount of media use (e_1) and an error

in the skill to practically use information (e_2) measured at the second survey, and for the covariance (s_2) of an error in the amount of media use (e_3) and an error in the skill to practically use information (e_4) measured at the third survey were examined.

Goodness of fit comparisons were made through χ^2 tests. As a result, the model in which Path (1) and Path (2) had an equal effect and in which the constraint that s_1 and s_2 were equal (Model1) was found fit for the causal relationships between the skill to practically use information and the amounts of use of various types of media except for the amount of time spent on creating Web pages. For the combination of the skill to practically use information and time spent on creating Web-pages, a model in which the constraint that s_1 and s_2 were equal (Model2) was found fit for the causal relationship between time spent on Web-page creation and the skill to practically use information.

When conducting covariance structural analyses, it is generally believed that fewer estimated paths will lead to more stable solutions. Therefore, as an analysis model to examine the relationship between the skill to practically use information and the amount of media use except for time spent on creating web-pages, Model 1 was chosen. For analysis of the relationship between time spent on creating Web-pages and the skill to practically use information, Model 2 was chosen as an analysis model.

Causal relationship between media use and the skill to practically use information

Table 2 shows standardized coefficients obtained from the analyses.

Causal relationship between Internet use and the skill to practically use information With regard to total time spent on Internet use, the ability to collect information measured at the first survey indicated positive effects on the amount of Internet use measured at the second survey, and also, the ability to collect information measured at the second survey indicated positive effects on the amount of Internet use measured at the third survey. Meanwhile, the ability to judge information measured at the first survey indicated negative effects on the amount of Internet use measured at the third survey.

With regard to time spent on e-mail use, the amount of use measured at the first survey indicated negative effects on the ability to create information measured at the second survey. However, the amount of e-mail use indicated positive effects on the total score for the skill to practically use information, the ability to judge information, and the ability to express information measured at the third survey. Also, the ability to process information measured at the first survey indicated positive effects on the amount of use measured at the second survey, and the ability to process information measured at the second survey indicated positive effects on the amount of use measured at the third survey.

With regard to time spent on Web-site viewing, the amount of use measured at the second survey indicated negative effects on the total score for the skill to practically use information and on the ability to express information measured at the third survey. However, the amount of use measured at the first survey indicated positive effects on the total score for the skill to practically use information, the ability to judge information, and the ability to express information measured at the third survey.

With regard to time spent on Web-page creation, the amount of use measured at the first survey indicated positive effects on the ability to communicate information measured at the second survey. On the other hand, the amount of use measured at the second survey indicated negative effects on the total score for the skill to practically use information, and the abilities to judge, express, and create information. Furthermore, the amount of use measured at the first survey indicated positive effects on the total score for the skill to practically use information, and the abilities to collect, judge, express, and create information. The total score for the skill to practically use information and the abilities to judge, express, process, and create information indicated positive effects on the time spent on Web-page creation measured at the third survey. Also, the total score for the skill to practically use information as well as the ability to express information measured at the first survey indicated negative effects on the time spent on Web-page creation measured at the third survey.

Causal relationships between the amount of other types of media and the skill to practically use information With regard to the amount of radio, TV and video game use, some significant effects were indicated. For example, with regard to the amount of TV use, the amount of use measured at the second survey indicated negative effects on the total score for the skill to practically use information as well as on the ability to express information measured at the

third survey. Still, with regard to video game use, the total score for the skill to practically use information, the ability to judge information, and the ability to process information measured at the first and second surveys indicated negative effects on the amount of video game use measured at the second and the third surveys. Although, differently from Internet use, any positive long-term effects of media on skill to practically use information were observed.

Table2. Causal relationships between the amount of media use and skill to practically use information

How to use	The skill to practically use information	model	first? second		second? third		first? third	
			use? skill	use? skill? use	use? skill	skill? use	use? skill	skill? use
Amount of Internet use								
Total time spent on Internet use	Total score	1	-.02	.05	-.04	.04	.00	-.05
	Collecting	1	.05	.07 *	.01	.06 *	-.05	-.03
	Judging	1	.00	.05	-.01	.05	.04	-.07 *
	Expressing	1	-.06	-.00	-.05	-.00	.04	-.03
	Processing	1	.00	.05	-.01	.04	.00	-.03
	Creating	1	-.05	-.02	-.02	-.02	.01	.03
	Communicating	1	-.03	.04	-.05	.03	.02	-.03
	<hr/>							
Time spent on e-mail use	Total score	1	-.04	.02	-.03	.01	.07 *	.02
	Collecting	1	.01	.01	.01	.01	.02	.02
	Judging	1	.02	.02	-.00	.02	.10 **	-.01
	Expressing	1	-.03	.01	-.04	.01	.08 *	.01
	Processing	1	-.02	.08 *	.01	.06 *	.02	-.05
	Creating	1	-.06 *	-.03	-.04	-.02	.05	.08
	Communicating	1	-.01	-.02	-.05	-.01	.05	.04
	<hr/>							
Time spent on Web-site viewing	Total score	1	.02	.02	-.09 **	.02	.08 *	-.01
	Collecting	1	.06	.04	-.04	.04	.05	.02
	Judging	1	.04	.00	-.05	.00	.11 **	-.02
	Expressing	1	-.01	.01	-.08 *	.01	.10 *	-.04
	Processing	1	.03	.03	-.04	.03	.05	-.02
	Creating	1	-.03	-.02	-.05	-.02	.04	.01
	Communicating	1	.03	.01	-.05	.01	.04	-.01
	<hr/>							
Time spent on Web-page creation	Total score	2	.02	-.06	-.08 *	.18 **	.11 ***	-.13 *
	Collecting	2	.01	-.05	-.06	.11	.09 **	-.09
	Judging	2	.04	-.06	-.08 *	.18 ***	.10 **	-.08
	Expressing	2	.02	-.05	-.11 **	.12 *	.11 **	-.10 *
	Processing	2	.02	.02	-.01	.14 *	.06	-.09
	Creating	2	-.01	-.05	-.07 *	.13 *	.10 **	-.08
	Communicating	2	.08 *	-.06	-.03	-.05	.06	.06
	<hr/>							
Amount of use of other types of media								
Amount of radio use								
Total score	Total score	1	.05	.03	.05	.03	-.09 *	-.02
	Collecting	1	.07 *	.07 *	.05	.06 *	-.05	-.04
	Judging	1	.04	.06 *	.08	.07 *	-.08	-.03
	Expressing	1	-.05	-.00	.02	-.00	-.07	-.04
	Processing	1	.07 *	-.01	.06	-.01	-.07	.01
	Creating	1	.02	-.01	.01	-.01	-.05	.01
	Communicating	1	-.01	-.01	.02	-.01	-.05	.01
	<hr/>							
Amount of TV use	Total score	1	-.02	-.00	-.09 *	-.00	.03	-.07
	Collecting	1	-.05	.01	-.06	.01	.06	-.09
	Judging	1	-.02	-.00	-.06	-.00	-.02	-.05
	Expressing	1	-.04	-.01	-.16 ***	-.01	.04	-.08
	Processing	1	.02	-.01	-.06	-.01	.01	-.04
	Creating	1	.01	-.04	-.01	-.04	-.01	-.01
	Communicating	1	.01	-.02	.01	-.02	-.07	.04
	<hr/>							
Amount of video game use	Total score	1	-.09 **	-.11 **	.09 **	-.11 **	-.03	-.02
	Collecting	1	-.09 **	-.02	.02	-.02	-.02	-.10 *
	Judging	1	-.04	-.07 **	.06	-.09 **	-.02	.03
	Expressing	1	-.17 ***	-.06	.01	-.06	-.00	-.08
	Processing	1	-.11 **	-.09 **	.09 *	-.10 **	-.03	-.00
	Creating	1	-.01	-.10 **	.05	-.11 **	.00	.02
	Communicating	1	-.04	-.10 **	-.01	-.10 **	-.05	-.02

* $p < .05$, ** $p < .01$, *** $p < .001$

Discussion

Causal relationships between the amount of media use and the skill to practically use information

The effects of Internet use This study did not detect any effect of overall Internet use, including the use of all the studied tools, to improve the skill to practically use information. When examining the effect of each tool, however, it was discovered that the use of tools did influence the skill to practically use information in a variety of ways.

Effects of the tools according to the analyses results could be sorted into the following rough categories: (1) there were no long-term or short-term effects; (2) there were no significant short-term effects, but positive long-term effects were observed; (3) there were negative short-term effects and positive long-term effects; and (4) there were positive short-term effects but no significant long-term effects.

Among the effects of Internet use on the skill to practically use information, there were no variables that indicated negative effects in both short-term and long-term. Thus, even though children use the Internet in the manner they wish to outside classes, it can be suspected at least that this would not suppress development of the skill to practically use information. Also, as there was no effect pattern of a combination of short-term positive effects and long-term negative effects, it can also be suspected that the short-term positive effects would not be canceled as time passes.

There was, however, an effect pattern of short-term negative effects and long-term positive effects. This suggests the possibility that, even if the use of a particular tool has short-term negative effects on the skill to practically use information, it will have positive effects in the longer term. Among the effects of tool use having this pattern, the positive effects that the time spent on Web-page creation measured at the first survey on the total score for the skill to practically use information and its sub-skills measured at the third survey were the most significant. Also, time spent on Web-page creation did not have any significant short-term effects on the ability to collect information; however, it did indicate long-term positive effects. The reasons for this can be attributed to the necessity of activities required to improve the Web-page content such as collection of a large volume of information, pursuit of uniqueness, and processing of obtained information into an appropriate and easy-to-see form. Such activities associated with Web-page creation may improve various aspects of the skill to practically use information.

The effects of other types of media In terms of the amount of radio, TV, or video game use, no variables indicated any short-term positive effects in which the amount of use measured at the first and second surveys both improved the skill to practically use information measured at the second and the third surveys respectively. Also, no long-term positive effects were detected either. Like the case of the amount of Internet use, no variables indicated both short-term and long-term negative effects on the skill to practically use information.

Importance of examination of long-term effects

In this study, the short-term and long-term effects of Internet use on the skill to practically use information were examined. The study results indicated virtually no short-term effects, but they did indicate some long-term effects. Collis et al. (96) conducted a survey with elementary school children and suggested based on the study result that the use of computers improved attitudes towards learning, such as motive for study or patience, after 4 years. Similarly, a certain amount of time may be necessary until it can be generalized that effects of Internet use can improve the skill to practically use information. Therefore, different effects of Internet use may have been detected if long-term observations had been conducted in the previous two-wave panel studies that examined the causal relationship between Internet use and the skill to practically use information (Mouri et al., 02; Takahira et al., 02). Considering the results of this study, it is desirable that in the future not only short-term effects but also long-term effects of more than one year be clarified when studying the effects of Internet use on the skill to practically use information.

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