International Journal of Education in Mathematics, Science and Technology (IJEMST)

www.ijemst.com

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To cite this article:

Lee, C.D. (2014). Worksheet usage, reading achievement, classes' lack of readiness and science achievement: A cross-country comparison. *International Journal of Education in Mathematics, Science and Technology*, *2*(2), 96-106.

IJEMST International Journal of Education in Mathematics, Science and Technology
Volume 2, Number 2, April 2014, Page 96-106 ISSN: 2147-611X

Worksheet Usage, Reading Achievement, Classes' Lack of Readiness, and Science Achievement: A Cross-Country Comparison

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Abstract

Instructional written materials play important roles as teachers' agents in effective teaching practices. Worksheets are one of the most frequently used materials. In this exploratory study, the relationships between worksheet usage and science achievement in 32 countries were examined through the use of TIMSS and PIRLS data and multiple regression analysis. Based on two dimensions, five types of relationships among science achievement, worksheet usage, and other related variables are identified. The first dimension is whether the status of significance in the association of worksheets used as a basis and science achievement changes before and after controlling four teacher and school variables: schools' emphases on academic success, safety and orderliness of school, teachers' confidence in teaching science, and instructional engagement of students. The second dimension is the interaction of worksheets as a basis and classes' lack of readiness. The interaction between worksheets as a basis and reading achievement in science achievement is found to be not significantly different from zero in all participating countries. Four directions of further investigation are suggested based on the results.

Key words: Science education, Worksheets, Elementary education, Secondary analysis

Introduction

Worksheets have been used in teaching practices for a long time. In modern time, worksheets have even become a driving force of curriculum in some countries (Lesley & Labbo, 2003; Martin, Mullis, Foy, & Stanco, 2012; Reid, 1984). Anderson et al. (1985) reported that in 1985, thousands of elementary students in the United States completed approximately 1,000 worksheets per person to acquire literacy in a school year. Teachers use worksheets for the purposes of supporting studying, promoting active learning, raising interest in learning science, and assessment. Many studies suggest that well-designed worksheets have had positive impacts on students' learning achievement (Sasmaz-Oren & Ormanci, 2012). However, researchers observed that there were many inappropriately designed and misused worksheets that hindered learning (Lesley & Labbo, 2003). In this exploratory study, the relationships between worksheet usage and science achievement in 32 countries are examined.

Worksheet and Achievement

Worksheets can be useful in many ways in terms of academic achievement. For example, as supplements to textbooks, worksheets can be used to add information for particular classes. In addition, blanks in worksheets are invitations for students to fill in gaps; they are opportunities for knowledge construction. Well-designed questions in worksheets can draw students' interest when paired with proper teaching methods. Furthermore, worksheets play a variety of functions in different contexts. McDowell and Waddling (1985) suggested that during laboratory investigations, properly designed worksheets can help teachers overcome the problems of time demanding and enable teachers to enhance students' acquisition of knowledge and skills. Kisiel (2003) pointed that in activities while visiting museums, worksheets can function as advance organizers, helping students to organize their observations and knowledge in a confusing learning environment. Krombab and Harms (2008) concluded that worksheets are effective in helping students aged 11–15 to acquire knowledge such as

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biodiversity in a natural history museum because they can structure the visit, keep students' attention on certain objects, and form a basis for follow-up coursework. As an assessment tool, worksheets can be used by teachers to understand students' previous knowledge, outcome of learning, and the process of learning; at the same time, they can be used to enable students to monitor the progress of their own learning.

In order to ensure worksheet's effectiveness, many studies focused on the design of worksheets (Campbell, 1999; Hoener, Salend, & Kay, 1997; Sasmaz-Oren & Ormanci, 2012). The basis for successfully transferring message to students is layout. To enhance teachers' abilities to design worksheets, Rotter (2006) proposed the layout principle COLA (contrast, orientation, lettering, and artwork). In worksheets, characteristics of questions are important factors. Calderhead et al. (2006) demonstrated that the arrangement of items with different levels of cognitive difficulty can affect students' learning results. Formats of information, or scaffolds, in worksheets are also of concern to educators. For instance Wolf et al. (2010) devised three formats of critical thinking tools to promote conceptual understanding in physical geography and Ueckert and Gess-Newsome (2008) advocated for a "conceptual flow graphic" to make active learning possible.

In addition to the positive impacts of worksheets on academic achievement, there are negative impacts. Lesley and Labbo (2003) argued that mass-produced worksheets are not helpful for achieving educational goals. Although the worksheets they observed were focused on literacy learning, their findings can still shed some light on worksheet usage for science learning. According to their remarks, the aspects of worksheet problems included the format of texts (e.g., that the print and the spaces allotted for students to write in are too small); reading demand (e.g., that the language of instruction was too complex and required teacher explanation); openness of questions, some of which offered only one correct way to respond and could not reward students for their natural curiosity; the challenge of tasks (e.g., that tasks were boring or designed for practicing skills repeatedly instead of making students learn new strategies or techniques), and the relationship between students' interests and tasks. In addition to the quality issues, as students completing worksheets, their cognitive processes can also make worksheets invalid. Ueckert and Gess-Newsome (2008) noted that students use a word-matching strategy match words in questions with the corresponding sentences in the textbook, and this keeps them in a passive learning status.

Worksheet, Reading Achievement, and Science Achievement

Worksheets are a kind of written material, so reading demand may be a barrier to students with low reading abilities. Researchers suggested that teachers should use easier language to support students (Rix, 2006). For example, O'Leary (2011) designed a format of worksheets with low average reading difficulty. Questions in the beginning are carefully matched with low reading ability students and subsequent questions require increasing levels of literacy. The result showed that this kind of worksheets can improve student engagement and on-task behavior during independent worksheet activities. There are a number of factors contributing to reading difficulty, such as organization of materials, syntax, word length, sentence length, word frequency, typeface, and line spacing (Department of Education and Science, 2007; Meyer, 2003; O'Leary, 2011). If teachers carefully control these factors and use available readability formulas to reduce the reading demand, or offer oral explanations to words in worksheets, the association between worksheet usage and science achievements will be the same regardless of students' reading achievements.

The debate about the difficulty of language used in worksheets has been raised in literature (O'Leary, 2011). Some researchers insist that easy language negates worksheets' abilities to challenge students and offer opportunities of language acquisition (Hayes, Wolfer, & Wolfe, 1996). In addition, although there are rules for controlling the reading demand, according to Reid's (1984) study, only about 30% of worksheet writers checked readability despite knowing that it is the essential. Under this kind of condition, students with low reading abilities have problems completing worksheets and the associations between worksheet usage and science achievement therefore differ among students with different reading levels.

Worksheet, Lack of Readiness, and Science Achievement

According to Reid (1984), teachers tend to use worksheets with low-achievement classes. The reasons for this tendency may be twofold. One is that textbooks are designed for general students and need to be adapted. However, worksheets can offer relevant questions and motivate students, both of which are functions that were ranked as best performed by teachers surveyed in the Reid's (1984) study. Secondly, as written material, worksheets are able to act as agents of teachers to lead students' attentions and give students opportunities to work independently, so the students can work at their own paces and the teacher can have time to take care of those students who need more help (McDowell & Waddling, 1985).

If worksheets are properly designed and used, they can support students' thought. However, many teachers are concerned by the "repetitive" nature of worksheets, the risks of student boredom, and a lack of the pedagogical knowledge and skills required to prevent children from thinking insufficiently before completing worksheets (Reid, 1984). These factors may cause failure in the application of worksheets in classes lacking readiness.

Research Questions

The purpose of this study is to explore the association between worksheet usage and science achievement in grade four students across the countries in the fifth cycle of the Trends in International Mathematics and Science Study (TIMSS 2011) and the third cycle of the Progress in International Reading Literacy Study (PIRLS 2011).

To gain an overview of the association, the first question that arises is: "Is there difference in science achievement between situations in which worksheets are used as a basis for instruction and those in which they are used as supplements, and between those in which they are used as supplements and those in which they are not used?"

To avoid the confounding effect of other teacher and school level variables, the four important variables, schools' emphasis on academic success (EAS), safty and orderliness of school (SOS), teachers' confidence in teaching science (CTS), and instructional engagement of students (IES), identified by Martin et al. (2012) are controlled. Accordingly, the second question is "After the four variables are controlled, is there difference in science achievement (SA) between those situations in which worksheets are used as a basis (WB) and those in which they are not used as a basis?"

In considering the issues about reading achievement (RA) and classes' lack of readiness (LR), the third and fourth questions examine "whether RA contributes to explanations of the variability in the relationship between WB and SA" and "whether LR contributes to explanations of the variablility in the relationship between worksheet as a basis (WB) and SA."

Method

Sample

This study is a secondary analysis research. Data were collected in TIMSS 2011 and PIRLS 2011. Thirty-four countries participated in both surveys (Martin & Mullis, 2013). The target population is grade four students in thirty-two countries and grade six students in two countries. In this study, the data from the thirty-two countries were analyzed.

TIMSS and PIRLS use two-stage stratified cluster sampling design (Martin et al., 2012). In each county, schools were selected first and one or two classes were selected from those schools. The students in the selected classes composed the sample. The sample size of each country was ranged from 3,121 to 14,720.

Dataset Preparation

After scaling, the International Association for the Evaluation of Educational Achievement (IEA) released the TIMSS and PIRLS 2011 datasets in September 2013. In the datasets, there are reading, science, and mathematics achievement scores with five plausible values; responses of items in achievement tests and background questionnaires; and derived background variables, such as students' confidence in learning science, teachers' confidence in teaching science, and safety and orderliness of school (Foy, 2013).

In this study, there is one dependent variable, SA, and seven independent variables: WB, RA, LR, EAS, SOS, CTS, and IES. SA and RA are achievement scores. EAS, SOS, CTS, and IES are derived teacher and school variables. The above six variables can be directly retrieved from the datasets provided by IEA (Foy, 2013). WB and LR are defined in this study as the following.

Worksheet usage was one item in the teacher questionnaire (Martin et al., 2012). Teachers were asked when they taught science to the class how they used "workbooks or worksheets." There were three options for them to choose from: "basis for instruction," "supplement," and "not used." Because the percentage of teachers who did

not use workbooks or worksheets was small or even zero in some countries, the responses were recorded in two categories, "as a basis" and "not as a basis."

The variable of LR was constructed with the use of three items in the teacher questionnaire. In the questionnaire, teachers were asked to what extent "students lacking prerequisite knowledge or skills," "disruptive students," and "uninterested students" limited how they taught their classes. There were four options for them to choose from: "a lot," "some," "not at all," and "not applicable." Every item was recoded in two-level variable: "A lot or some (level 1)" and "not at all or not applicable (level 0)." The three indicators were treated as formative, and LR was the standardized sum of the three recoded variables.

Analytical Strategy

Multiple regression is used to answer the research questions. The issue of estimation of standard error has to be addressed first because the sampling method in TIMSS and PIRLS is stratified cluster sampling instead of simple random sampling. To correctly estimate sampling error, the Jackknife repeated replication methodology was applied. To correctly estimate measurement error, the plausible-value method was applied. The IDB Analyzer developed by the IEA Data Processing and Research Center (2013) was used with the statistical software SPSS to implement the two above methods in regression analysis.

To test the significance of the differences between group means of science achievement, Model 0 was analyzed.

Model 0:

$$\mathrm{SA} = \mathrm{c}_0 + c_{WAB} \cdot WAB + c_{WNO} \cdot WNO$$

WAB stands for "using worksheets as a basis" and WNO stands for "not using worksheets." The reference group is students taught by teachers "using worksheets as supplements (WSP)." The value of c_{WAB} is the difference in average science achievements for students taught by teachers WAB and WSP. The value of c_{WNO} is the difference in average science achievements for students taught by teachers WNO and WSP.

To examine the effect of controlling the four teacher and school variables (EAS, SOS, CTS, and IES), Model 1 and Model 2 were compared.

Model 1:

$$\mathrm{SA} = \mathrm{c}_0 + c_{WB} \cdot WB$$

WB stands for "using worksheets as a basis." The value of c_{WB} is the difference in average science achievements for students taught by teachers using worksheets as a basis and not as a basis.

Model 2:

$$\mathrm{SA} = \mathrm{c}_0 + c_{WB} \cdot WB + c_{EAS} \cdot EAS + c_{S0S} \cdot SOS + c_{CTS} \cdot CTS + c_{IES} \cdot IES$$

To test the significance of the interaction between WB and RA in SA, Model 3 was analyzed. In Model 3, RA is centered on class mean because the relationship between RA and SA on an individual level is concerned and so RA should not include the effect of class-level and above-class-level variables (Hoffman & Gavin, 1998).

Model 3:

$$\begin{aligned}\mathrm{SA} = \mathrm{c}_0 &+ c_{WB} \cdot WB + c_{EAS} \cdot EAS + c_{S0S} \cdot SOS + c_{CTS} \cdot CTS + c_{IES} \cdot IES \\ &+ c_{RA} \cdot (RA - \overline{RA}_{class}) + c_{WB \cdot RA} \cdot WB \cdot (RA - \overline{RA}_{class})\end{aligned}$$

To test the significance of the interaction between WB and LR on SA, Model 4 was analyzed.

Model 4:

$$\begin{aligned}\mathrm{SA} = \mathrm{c}_0 &+ c_{WB} \cdot WB + c_{EAS} \cdot EAS + c_{S0S} \cdot SOS + c_{CTS} \cdot CTS + c_{IES} \cdot IES \\ &+ c_{RA} \cdot (RA - \overline{RA}_{class}) + c_{WB \cdot RA} \cdot WB \cdot (RA - \overline{RA}_{class}) \\ &+ c_{LR} \cdot LR + c_{WR \cdot LR} \cdot WB \cdot LR\end{aligned}$$

Results

Association between Worksheet Usage and Science Achievement

As shown in Table 1, on average across countries, 42% of students used worksheets as a basis, 56% of students used worksheets as supplements, and only 2% of students did not use worksheets. The percentage of students not using worksheets is larger than 5% only in five countries, Australia, Finland, Iran, Malta, and Sweden, and is zero in five countries, Croatia, Georgia, Norway, Singapore, and Taiwan.

Table 1 shows that the difference in average science achievements for students taught by teachers using worksheets as a basis and as supplements is significant in eight out of the 32 countries. The average science achievement of students taught by teachers using worksheets as a basis is higher in only two of the eight countries, the Czech Republic and Saudi Arabia. The international average difference is significantly less than zero (-4.2).

Association between Worksheet Usage and Science Achievement after Controlling Teacher and School Variables

Table 2 provides the information about the difference in average science achievements between students taught by teachers using worksheets as a basis and not as a basis (as seen in the column of WB in Model 1. i.e., the coefficient of WB). As shown in the coefficient of WB in Model 2 (Table 2), after controlling the variables of EAS, SOS, CTS, and IES, the difference in average science achievements for students taught by teachers using worksheets as a basis and those taught by teachers not using them as a basis is significantly different from zero in six countries. In five out of the six countries, Italy, Northern Ireland, Qatar, Saudi Arabia, and the United Arab Emirates, the difference is significant in Model 1, too. The sixth country is Germany, in which the difference is insignificant in Model 1. After controlling the four teacher and school variables, the coefficient of WB is insignificant in the Czech Republic, Malta, and Singapore while the coefficient is significant before controlling the four variables (Model 1) in these three countries.

Interaction between Worksheets as a Basis and Reading Achievement

The coefficient of WB*RA in Model 3 (Table 2) show there is no statistically significant interaction between worksheets as a basis and reading achievement in the prediction of science achievement in all countries.

Interaction between Worksheets as a Basis and Class's Lack of Readiness

According to the information provided by Table 2 in the column WB*LR, the interaction between WB and LR in students' science achievement is significant in eight out of the 32 countries. In the eight countries, the coefficient of the interaction term is positive in six countries and negative in two countries.

The coefficient is positive for students in Australia, Finland, Morocco, Norway, Qatar, and the United Arab Emirates. The positive value of the coefficient of WB*LR means that the effect of WB on science achievement for students in classes lacking readiness is higher than it for those in classes not lacking readiness. For example, in Finland, after controlling EAS, SOS, CTS, EIS, and RA, the association of WB and SA for students in classes not lacking readiness (LR=0) is -1.4 and is not significantly different from zero; the association for students in classes lacking readiness (LR=1) is 8.6 (=-1.4+10.0), which is significantly different from zero. In other words, in Finland, worksheets are more effective for students in classes lacking readiness to learn science. In Qatar and the United Arab Emirates, the situation is slightly different. In both countries in which the association for students in classes not lacking readiness (LR=0) is negative (-64.3 and -33.2), the association for students in classes lacking readiness (LR=1) is still negative (-38.1 and -10.5). In spite of this, the effect size becomes smaller, which means the negative association of worksheets is reduced when they are applied to classes lacking readiness.

On the contrary, in Italy and Malta, the coefficient is negative. Worksheets in both countries are less effective for students in classes lacking readiness to learn science. After controlling EAS, SOS, CTS, EIS, and RA, the association of WB and SA for students in classes not lacking readiness (LR=0) is -11.7 for Italy and 5.1 for Malta; the association for students in classes lacking readiness (LR=1) is -31.5 for Italy and 1.2 for Malta.

Table 1: Worksheet usage and average science achievement (results from Model 0)

Country	Worksheet As a Basis		Worksheet as Supplements		Worksheet Not Used		$SA_{WAB} - SA_{WSP}$	$SA_{WNO} - SA_{WSP}$
	Percent of Students	Average SA	Percent of Students	Average SA	Percent of Students	Average SA		
Australia	15.5 (3.2)	504.8 (8.7)	75.9 (3.7)	518.5 (4.0)	8.6 (2.4)	513.2 (9.4)	-13.8 (9.5)	-5.3 (10.5)
Austria	33.3 (2.9)	530.2 (3.8)	66.5 (2.9)	526.5 (3.0)	0.2 (0.2)	532.6 (5.8)	3.7 (4.4)	6.1 (6.9)
Azerbaijan	33.9 (3.8)	448.2 (9.0)	65.4 (3.9)	426.6 (7.8)	0.7 (0.5)	410.3 (11.4)	21.6 (11.5)	-16.2(14.2)
Croatia	28.7 (3.4)	511.7 (3.0)	71.3 (3.4)	513.0 (2.2)	0.0 (0.0)	- -	-1.2 (3.6)	- -
Czech Rep.	44.9 (3.8)	538.3 (3.7)	51.9 (3.8)	527.9 (3.1)	3.2 (1.6)	539.9 (10.1)	10.4 (4.9)*	12.0 (10.6)
Finland	39.6 (3.0)	565.4 (3.3)	54.2 (3.3)	570.3 (2.6)	6.2 (1.7)	565.3 (12.4)	-4.9 (3.9)	-5.0 (13.1)
Georgia	53.7 (4.1)	449.4 (6.0)	46.3 (4.1)	451.8 (5.6)	0.0 (0.0)	- -	-2.4 (9.0)	- -
Germany	58.4 (3.5)	523.3 (3.1)	41.4 (3.5)	529.3 (3.4)	0.1 (0.1)	519.4 (11.7)	-6.0 (4.7)	-9.9 (12.4)
Hong Kong	44.3 (4.8)	543.7 (4.3)	55.0 (4.7)	532.1 (4.1)	0.7 (0.7)	548.1 (6.9)	11.6 (6.1)	16.0 (7.2)*
Hungary	70.3 (3.3)	528.9 (4.8)	27.7 (3.4)	531.2 (7.9)	2.0 (0.9)	537.9 (20.7)	-2.3 (10.3)	6.6 (23.2)
Iran	14.9 (3.3)	438.1 (11.5)	78.8 (3.5)	454.1 (4.5)	6.3 (1.5)	398.9 (20.6)	-16.0(13.5)	-55.2(21.4)*
Ireland	11.7 (2.3)	503.9 (8.9)	85.5 (2.6)	514.1 (3.4)	2.9 (1.2)	521.4 (11.5)	-10.2 (9.8)	7.3 (11.2)
Italy	23.3 (3.3)	505.7 (7.1)	76.0 (3.2)	528.1 (2.6)	0.7 (0.7)	458.4 (7.0)	-22.4 (7.5)*	-69.7 (0.0)
Lithuania	69.7 (3.6)	509.8 (2.8)	30.1 (3.5)	510.0 (5.1)	0.2 (0.2)	462.2 (8.4)	-0.2 (6.0)	-47.8(10.5)*
Malta	33.7 (0.1)	437.3 (2.6)	58.1 (0.1)	444.5 (2.1)	8.2 (0.1)	438.2 (3.8)	-7.3 (2.7)*	-6.3 (4.2)
Morocco	67.9 (3.3)	240.8 (5.6)	28.0 (3.3)	243.0 (10.3)	4.2 (1.5)	275.6 (35.9)	-2.2 (12.7)	32.7 (38.5)
North. Ireland	16.3 (3.0)	498.9 (6.7)	82.2 (3.2)	516.7 (3.3)	1.5 (1.1)	489.8 (22.6)	-17.8 (7.5)*	-26.8(23.4)
Norway	39.2 (5.2)	489.4 (4.2)	60.8 (5.2)	488.6 (2.4)	0.0 (0.0)	- -	0.8 (4.6)	- -
Oman	45.5 (3.1)	361.9 (5.6)	54.3 (3.1)	376.1 (5.7)	0.2 (0.1)	353.9(103.6)	-14.2 (8.1)	-22.2(103.4)
Poland	57.8 (3.8)	499.0 (3.1)	41.9 (3.9)	500.3 (3.0)	0.4 (0.4)	556.4 (7.3)	-1.3 (4.2)	56.0 (0.0)
Portugal	34.5 (4.0)	523.8 (4.8)	63.6 (4.1)	516.2 (5.4)	1.9 (1.5)	488.3 (7.0)	7.6 (7.0)	-27.8 (8.6)*
Qatar	57.0 (2.9)	359.2 (7.4)	41.5 (3.1)	419.4 (10.7)	1.5 (0.9)	492.3 (20.7)	-60.1(14.1)*	72.9 (25.9)*
Romania	35.8 (4.1)	499.0 (9.0)	64.0 (4.2)	501.2 (8.5)	0.1 (0.1)	438.9 (17.3)	-2.2 (12.5)	-62.3(19.1)*
Russian Fed.	47.7 (4.2)	551.5 (4.7)	50.8 (4.1)	545.8 (4.0)	1.4 (0.8)	548.7 (66.6)	5.8 (5.8)	3.0 (66.8)
Saudi Arabia	51.6 (4.0)	441.7 (7.3)	46.6 (3.9)	402.4 (9.0)	1.8 (0.9)	441.4 (46.5)	39.3(12.3)*	39.0 (48.2)
Singapore	68.6 (2.6)	574.6 (4.3)	31.4 (2.6)	589.4 (5.6)	0.0 (0.0)	- -	-14.8 (7.3)*	- -
Slovak Rep.	38.5 (3.0)	530.3 (5.3)	58.9 (3.2)	527.8 (3.8)	2.6 (1.3)	474.1 (22.7)	2.5 (5.7)	-53.7(23.4)*
Slovenia	50.3 (3.8)	512.5 (2.7)	48.2 (3.9)	520.3 (3.3)	1.5 (0.8)	504.8 (21.0)	-7.8 (4.6)	-15.5(20.6)
Spain	34.0 (3.7)	507.9 (5.2)	63.9 (3.7)	498.7 (3.6)	2.0 (0.9)	495.3 (17.7)	9.2 (6.5)	-3.5 (18.1)
Sweden	18.5 (3.8)	527.5 (8.0)	67.5 (4.7)	531.4 (4.0)	14.0 (3.6)	539.9 (4.6)	-3.9 (8.2)	8.6 (6.1)
Taiwan	44.2 (4.1)	549.0 (2.6)	55.8 (4.1)	547.6 (3.0)	0.0 (0.0)	- -	1.4 (4.3)	- -
UAE	53.5 (2.4)	406.5 (3.9)	45.9 (2.4)	442.9 (5.2)	0.6 (0.2)	440.2 (42.5)	-36.4 (7.7)*	-2.7 (42.9)
Int. Average	41.8 (0.6)	487.9 (1.0)	55.9 (0.6)	492.1 (0.9)	2.3 (0.2)	480.9 (5.8)	-4.2 (1.4)*	-6.3 (6.0)

Note: SA_{WAB} =Average science achievement of students using worksheets as a basis; SA_{WSP} = Average science achievement of students using worksheets as supplements; SA_{WNO} = Average science achievement of students not using worksheets; UAE = United Arab Emirates
(): Standard errors appear in parentheses. *p< .05

Table 2: Coefficients for multiple regression analysis

Country	Model	Worksheet as a Basis (WB)	Reading Ach. (RA)	WB*RA	Lack of Readiness (LR)	WB*LR	Controlled Variable			
							EAS	SOS	CTS	IES
Australia	M1	-13.2 (9.4)								
	M2	-8.2 (9.6)					3.2 (2.1)	7.1(2.2)*	0.7 (1.5)	1.8 (1.9)
	M3	-5.7 (9.6)	0.76 (0.02)*	0.03 (0.05)			3.1 (2.1)	7.1(2.2)*	1.0 (1.4)	1.7 (1.9)
	M4	-14.0(12.5)	0.76 (0.02)*	0.03 (0.04)	-17.2(3.0)*	35.4(15.6)*	1.0 (2.1)	5.9(2.2)*	2.0 (1.3)	0.1 (1.9)
Austria	M1	3.7 (4.4)								
	M2	-0.1 (4.2)					4.8 (1.4)*	4.4(1.5)*	-2.4(1.2)*	-1.7 (1.3)
	M3	-0.6 (4.2)	0.85 (0.01)*	-0.04(0.03)			4.8 (1.4)*	4.4(1.6)*	-2.2 (1.2)	-1.6 (1.2)
	M4	-0.8 (4.2)	0.84 (0.01)*	-0.04(0.03)	-3.7 (2.4)	-2.7 (3.8)	4.3 (1.4)*	3.8(1.6)*	-2.5(1.2)*	-2.0 (1.3)
Azerbaijan	M1	21.8 (11.5)								
	M2	18.5 (11.5)					4.7 (2.6)	0.0 (3.1)	2.7 (4.9)	1.9 (3.4)
	M3	18.4 (11.4)	0.54 (0.04)*	-0.04(0.07)			4.7 (2.6)	0.0 (3.1)	2.6 (5.0)	1.7 (3.4)
	M4	21.0 (12.7)	0.52 (0.04)*	-0.03(0.08)	-7.8 (6.3)	5.0 (9.6)	3.4 (3.0)	-0.7 (3.2)	5.2 (4.7)	-0.3 (3.4)
Croatia	M1	-1.2 (3.6)								
	M2	-0.7 (3.6)					3.5 (1.4)*	-1.2 (1.2)	-1.6 (1.1)	1.3 (1.2)
	M3	-1.5 (3.7)	0.77 (0.02)*	-0.01(0.02)			0.5 (0.9)	-0.8 (1.2)	-1.5 (1.0)	1.2 (1.2)
	M4	0.8 (4.2)	0.77 (0.02)*	-0.01(0.02)	-2.2 (2.4)	5.6 (3.7)	0.6 (0.9)	-0.8 (1.2)	-1.5 (1.0)	1.4 (1.1)
Czech Republic	M1	9.7 (4.8)*								
	M2	9.0 (4.9)					0.6 (0.9)	-1.8 (1.1)	0.7 (1.4)	1.4 (1.5)
	M3	9.9 (4.8)*	0.88 (0.03)*	0.01 (0.03)			2.3 (1.4)	-1.5 (1.2)	0.6 (1.4)	1.4 (1.5)
	M4	8.7 (4.9)	0.88 (0.03)*	0.01 (0.03)	-6.7 (3.8)	1.3 (5.4)	1.9 (1.4)	-1.7 (1.2)	0.3 (1.4)	1.5 (1.3)
Finland	M1	-4.4 (3.9)								
	M2	-4.4 (3.7)					2.2 (1.5)	5.0(1.0)*	-0.5 (1.1)	0.7 (1.3)
	M3	-4.7 (3.5)	0.73 (0.02)*	0.00 (0.03)			1.0 (1.4)	5.2(1.0)*	-0.2 (1.1)	0.2 (1.4)
	M4	-1.4 (3.8)	0.73 (0.02)*	0.00 (0.03)	-7.7 (2.2)*	10.0 (3.6)*	0.9 (1.3)	4.2(1.1)*	0.0 (1.0)	-0.6 (1.4)
Georgia	M1	-2.4 (9.0)								
	M2	-4.2 (9.1)					1.2 (1.4)	1.8 (2.8)	-0.9 (2.7)	-0.7 (2.2)
	M3	-4.5 (9.1)	0.82 (0.02)*	-0.03(0.02)			5.1 (2.2)*	2.0 (2.8)	-0.8 (2.6)	-0.5 (2.2)
	M4	-9.7 (9.2)	0.82 (0.02)*	-0.02(0.02)	2.2 (4.2)	-7.6 (5.7)	4.9 (2.2)*	2.0 (2.9)	-0.7 (2.6)	-0.4 (2.1)
Germany	M1	-5.9 (4.7)								
	M2	-8.8 (3.4)*					5.1 (2.2)*	2.3 (1.4)	-0.9 (1.4)	-4.3(1.3)*
	M3	-8.4 (3.3)*	0.78 (0.04)*	0.03 (0.03)			10.4(1.8)*	2.6 (1.3)	-0.8 (1.4)	-4.6(1.3)*
	M4	-7.2 (3.4)*	0.78 (0.04)*	0.03 (0.03)	-4.4 (3.3)	1.0 (4.5)	9.8 (1.8)*	3.0(1.3)*	-1.1 (1.4)	-4.8(1.3)*
Hong Kong	M1	11.4 (6.1)								
	M2	10.3 (6.0)					10.7(1.8)*	1.4 (1.9)	-3.3(1.4)*	-1.1 (1.6)
	M3	9.8 (6.0)	0.72 (0.03)*	0.01 (0.04)			-0.1 (1.6)	1.5 (2.0)	-3.5(1.4)*	-1.1 (1.6)
	M4	7.5 (6.1)	0.72 (0.03)*	0.01 (0.04)	-3.5 (3.7)	-6.8 (4.1)	-0.4 (1.5)	0.7 (2.0)	-3.8(1.3)*	-1.6 (1.6)
Hungary	M1	-2.8 (9.8)								
	M2	-8.7 (8.4)					0.0 (1.6)	4.6 (2.4)	-4.7 (1.8)*	-2.1 (1.9)
	M3	-10.1 (8.5)	0.82 (0.02)*	0.02 (0.03)			11.6(2.0)*	5.0(2.4)*	-5.0 (1.9)*	-1.9 (1.9)
	M4	-10.8 (8.4)	0.82 (0.02)*	0.02 (0.03)	-0.5 (5.9)	-5.1 (7.2)	11.3(2.0)*	4.1 (2.4)	-5.0 (1.9)*	-2.7 (1.9)
Iran	M1	-11.9 (13.5)								
	M2	-13.0 (14.3)					11.9(2.0)*	4.1 (2.4)	-2.5 (2.8)	3.9 (2.5)
	M3	-13.4 (14.3)	0.87 (0.02)*	-0.02(0.04)			7.4 (2.5)*	3.9 (2.4)	-2.5 (2.8)	3.9 (2.5)
	M4	-17.4 (13.8)	0.87 (0.02)*	-0.02(0.04)	-8.9 (5.7)	-15.2(11.9)	7.1 (2.5)*	1.9 (2.5)	-4.4 (3.0)	4.6 (2.4)

Note: EAS = Emphasis on Academic Success; SOS = Safety and Orderliness of School; CTS = Confidence in Teaching Science; IES = Instructional Engagement of Students.
(): Standard errors appear in parentheses. *p< .05

Table 2 (*cont.*): Coefficients for multiple regression analysis

Country	Model	Worksheet as a Basis (WB)	Reading Ach. (RA)	WB*RA	Lack of Readiness (LR)	WB*LR	Controlled Variable			
							EAS	SOS	CTS	IES
Ireland	M1	-10.4 (9.8)								
	M2	-4.8 (9.5)					7.3 (2.5)*	5.9(1.8)*	3.4(1.6)*	-4.7(1.7)*
	M3	-4.3 (9.8)	0.78 (0.02)*	0.04 (0.04)			5.9 (1.5)*	6.1(1.7)*	3.1 (1.6)	-4.9(1.6)*
	M4	-2.6 (9.6)	0.78 (0.02)*	0.04 (0.04)	-4.7 (2.5)	6.8 (8.0)	5.3 (1.5)*	5.5(1.7)*	2.7 (1.6)	-4.7(1.7)*
Italy	M1	-21.8(7.5)*								
	M2	-18.9(8.0)*					5.7 (1.5)*	3.0 (2.1)	-0.2 (1.9)	-1.8(1.4)
	M3	-19.0(7.9)*	0.78 (0.02)*	-0.02(0.04)			0.0 (1.7)	3.0 (2.1)	-0.3 (1.9)	-1.5 (1.4)
	M4	-11.7 (7.8)	0.78 (0.02)*	-0.01(0.04)	10.4 (4.2)*	-19.8(6.5)*	1.1 (1.7)	3.7 (2.1)	-0.7 (1.9)	-2.8(1.3)*
Lithuania	M1	0.2 (5.9)								
	M2	-2.7 (5.8)					0.2 (1.7)	1.2 (1.6)	-1.3 (1.7)	0.1 (1.6)
	M3	-3.1 (5.7)	0.75 (0.03)*	0.01 (0.04)			5.4 (2.0)*	1.1 (1.6)	-1.5 (1.7)	0.2 (1.6)
	M4	-4.0 (6.1)	0.75 (0.03)*	0.01 (0.04)	-7.1 (5.2)	1.2 (5.5)	4.7 (2.0)*	1.1 (1.6)	-1.9 (1.7)	-0.1 (1.6)
Malta	M1	-6.5 (2.6)*								
	M2	3.6 (2.6)					5.8 (1.9)*	4.4(0.7)*	2.8(0.6)*	-6.1(0.8)*
	M3	4.2 (1.6)*	0.74 (0.02)*	0.00 (0.04)			5.1 (0.5)*	4.2(0.5)*	2.8(0.4)*	-6.1(0.5)*
	M4	5.1 (1.5)*	0.74 (0.02)*	0.00 (0.04)	0.5 (0.9)	-3.9 (1.5)*	5.1 (0.5)*	4.1(0.6)*	2.9(0.4)*	-6.0(0.5)*
Morocco	M1	-6.5 (12.4)								
	M2	-9.5 (12.8)					4.8 (0.6)*	6.3(3.0)*	1.2 (4.1)	3.5 (3.1)
	M3	-7.4 (12.8)	0.66 (0.05)*	0.01 (0.06)			6.7 (4.3)	6.0(3.0)*	1.6 (4.1)	3.4 (3.0)
	M4	-39.7(21.5)	0.66 (0.05)*	0.01 (0.06)	-51.2(23.1)*	57.2(25.1)*	7.7 (4.3)	5.7(2.8)*	1.0 (4.1)	1.3 (2.9)
Northern Ireland	M1	-17.3(7.5)*								
	M2	-18.6(6.9)*					7.1 (4.3)	5.8(1.8)*	-0.1 (1.5)	-1.7 (1.8)
	M3	-19.4(6.9)*	0.69 (0.01)*	-0.04(0.06)			3.3 (1.7)*	6.0(1.8)*	-0.1 (1.5)	-2.0 (1.8)
	M4	-22.5(6.9)*	0.70 (0.01)*	-0.04(0.05)	-6.8 (2.9)*	-10.7 (5.8)	2.2 (1.6)	4.7(1.7)*	0.2 (1.4)	-1.9 (1.9)
Norway	M1	0.8 (4.6)								
	M2	1.0 (4.0)					3.2 (1.7)	3.0 (1.6)	-2.5 (1.4)	1.4 (1.5)
	M3	0.7 (4.1)	0.78 (0.03)*	0.02 (0.04)			5.2 (1.5)*	3.1(1.6)*	-2.4 (1.3)	1.0 (1.4)
	M4	4.7 (4.8)	0.78 (0.03)*	0.02 (0.04)	-9.8 (2.3)*	11.2 (4.5)*	4.8 (1.4)*	3.2(1.5)*	-2.8 (1.4)	0.6 (1.4)
Oman	M1	-14.1 (8.1)								
	M2	-12.0 (7.1)					5.1 (1.5)*	5.8(2.8)*	-3.6 (2.7)	2.2 (2.5)
	M3	-11.4 (7.2)	0.92 (0.02)*	0.01 (0.02)			7.2 (2.3)*	5.5(2.8)*	-3.6 (2.7)	2.3 (2.5)
	M4	-14.4(7.1)*	0.92 (0.02)*	0.01 (0.02)	-2.3 (7.1)	3.6 (8.9)	6.8 (2.4)*	5.0 (2.9)	-2.5 (2.7)	2.3 (2.6)
Poland	M1	-1.8 (4.1)								
	M2	-4.4 (3.9)					7.2 (2.4)*	-3.6(1.6)*	1.7 (1.5)	-1.3 (1.1)
	M3	-5.3 (3.9)	0.84 (0.02)*	0.01 (0.03)			3.6 (1.5)*	-3.2(1.6)*	1.6 (1.5)	-1.4 (1.1)
	M4	-5.3 (3.9)	0.83 (0.02)*	0.01 (0.03)	-1.8 (2.7)	-2.6 (4.2)	3.6 (1.5)*	-4.0(1.5)*	1.6 (1.5)	-1.5 (1.2)
Portugal	M1	8.4 (7.0)								
	M2	8.3 (7.8)					3.8 (1.4)*	0.6 (2.7)	-0.8 (2.1)	-1.6 (1.5)
	M3	7.5 (7.9)	0.77 (0.02)*	-0.05(0.03)			9.6 (2.2)*	0.9 (2.7)	-0.7 (2.1)	-1.5 (1.5)
	M4	7.6 (7.5)	0.77 (0.02)*	-0.05(0.03)	-0.4 (6.2)	1.0 (7.2)	9.6 (2.5)*	0.9 (2.7)	-0.8 (1.9)	-1.5 (1.5)
Qatar	M1	-62.7(13.4)*								
	M2	-61.4(14.0)*					9.4 (2.2)*	4.7 (3.1)	0.5 (4.2)	-3.4 (4.0)
	M3	-61.4(14.0)*	0.83 (0.03)*	0.05 (0.04)			5.5 (4.4)	4.9 (3.1)	0.8 (4.2)	-3.3 (4.0)
	M4	-64.3(13.2)*	0.83 (0.03)*	0.05 (0.04)	-38.1(8.0)*	26.2(9.8)*	3.3 (4.1)	3.7 (3.5)	0.1 (3.6)	-4.0 (3.7)

Note: EAS = Emphasis on Academic Success; SOS = Safety and Orderliness of School; CTS = Confidence in Teaching Science; IES = Instructional Engagement of Students.
(): Standard errors appear in parentheses. *p< .05

Table 2 (*cont.*): Coefficients for multiple regression analysis

Country	Model	Worksheet as a Basis (WB)	Reading Ach. (RA)	WB*RA	Lack of Readiness (LR)	WB*LR	Controlled Variable			
							EAS	SOS	CTS	IES
Romania	M1	-2.0 (12.5)								
	M2	-0.8 (12.5)					5.9 (4.3)	-2.6 (3.9)	-11.4(5.0)*	-0.8 (2.8)
	M3	-2.0 (12.5)	0.85 (0.03)*	-0.01(0.03)			10.2(3.1)*	-2.8 (3.9)	-11.8(5.0)*	-0.5 (2.9)
	M4	-3.7 (11.6)	0.85 (0.03)*	0.00 (0.03)	-25.4(8.5)*	5.9 (9.9)	7.7 (2.9)*	-5.3 (4.0)	-9.0 (4.8)	-0.8 (3.0)
Russian Federation	M1	5.7 (5.7)								
	M2	5.1 (5.6)					9.8 (3.1)*	-0.3 (2.3)	0.0 (3.3)	2.3 (1.9)
	M3	4.5 (5.6)	0.71 (0.03)*	-0.01(0.03)			3.0 (2.0)	-0.3 (2.4)	-0.2 (3.3)	2.3 (1.9)
	M4	6.3 (6.7)	0.71 (0.03)*	-0.01(0.03)	-2.5 (4.5)	4.6 (6.1)	2.5 (2.3)	-0.3 (2.5)	-0.1 (3.3)	2.4 (1.9)
Saudi Arabia	M1	37.9(12.1)*								
	M2	23.8(12.1)*					2.8 (2.0)	-1.6 (3.7)	4.1 (4.2)	0.5 (2.7)
	M3	23.2 (12.0)	0.82 (0.02)*	0.00 (0.04)			7.6 (3.0)*	-1.9 (3.6)	4.5 (4.3)	0.8 (2.7)
	M4	32.9(11.6)*	0.82 (0.02)*	-0.01(0.04)	8.0 (8.2)	-14.4(10.4)	7.3 (3.3)*	-2.8 (3.6)	3.5 (4.4)	1.3 (2.7)
Singapore	M1	-14.8 (7.3)*								
	M2	-12.1 (7.0)					8.1 (3.0)*	3.6 (2.4)	-2.2 (1.8)	-2.1 (1.5)
	M3	-13.1 (7.0)	0.81 (0.03)*	-0.01(0.04)			6.7 (2.4)*	3.3 (2.4)	-2.2 (1.8)	-1.9 (1.5)
	M4	-11.3 (6.3)	0.80 (0.03)*	0.00 (0.03)	-26.7(7.1)*	0.7 (7.8)	4.8 (2.2)*	1.0 (2.2)	-3.1 (1.7)	-3.4(1.5)*
Slovak Republic	M1	4.8 (5.8)								
	M2	0.2 (5.8)					6.6 (2.4)*	-0.4 (2.8)	-1.3 (1.6)	-2.3 (1.9)
	M3	1.0 (5.8)	0.85 (0.02)*	-0.04(0.03)			9.8 (3.0)*	-0.4 (2.8)	-1.1 (1.6)	-2.4 (1.9)
	M4	-2.4 (8.1)	0.85 (0.02)*	-0.04(0.03)	-7.6 (3.4)*	-1.0 (5.7)	7.8 (3.1)*	-0.5 (3.0)	-1.0 (1.6)	-2.9 (2.0)
Slovenia	M1	-7.3 (4.7)								
	M2	-7.5 (4.9)					9.8 (3.0)*	1.2 (1.3)	0.1 (1.0)	-2.1 (1.3)
	M3	-7.5 (4.8)	0.83 (0.02)*	0.03 (0.03)			3.2 (1.4)*	1.1 (1.3)	0.2 (1.0)	-2.0 (1.2)
	M4	-8.2 (4.7)	0.83 (0.02)*	0.03 (0.03)	-12.3(4.3)*	7.6 (4.8)	2.1 (1.5)	0.7 (1.2)	0.4 (1.0)	-2.2 (1.2)
Spain	M1	9.3 (6.5)								
	M2	4.8 (6.6)					3.1 (1.4)*	4.6(1.7)*	1.0 (1.8)	-1.0 (1.6)
	M3	5.5 (6.5)	0.75 (0.03)*	0.04 (0.04)			3.0 (1.8)	5.0(1.6)*	0.9 (1.8)	-1.2 (1.6)
	M4	5.3 (7.1)	0.75 (0.02)*	0.04 (0.04)	-6.4 (3.3)	2.4 (5.1)	2.6 (1.8)	4.3(1.6)*	1.2 (1.9)	-1.4 (1.7)
Sweden	M1	-5.4 (7.9)								
	M2	-11.6 (7.3)					3.0 (1.8)	7.6(1.6)*	-3.0 (1.4)*	2.8 (1.4)*
	M3	-11.8 (7.3)	0.84 (0.03)*	0.05 (0.04)			3.7 (1.6)*	7.3(1.6)*	-3.1 (1.5)*	2.8 (1.4)*
	M4	-20.6 (10.7)	0.84 (0.03)*	0.05 (0.04)	2.5 (2.7)	-7.7 (8.2)	4.3 (1.5)*	7.1(1.5)*	-2.6 (1.4)	3.1 (1.4)*
Taiwan	M1	1.4 (4.3)								
	M2	-0.5 (4.2)					3.1 (1.5)*	-0.2 (1.4)	1.1 (1.4)	-0.2 (1.1)
	M3	-0.6 (4.2)	0.82 (0.02)*	-0.01(0.02)			3.7 (1.4)*	-0.2 (1.4)	1.1 (1.4)	-0.3 (1.1)
	M4	-1.0 (4.4)	0.82 (0.02)*	-0.01(0.02)	-4.2 (3.3)	2.9 (3.9)	3.3 (1.5)*	-0.3 (1.4)	1.1 (1.4)	-0.4 (1.1)
UAE	M1	-36.4 (7.7)*								
	M2	-34.1 (7.6)*					7.7 (2.0)*	2.2 (2.4)	2.1 (3.1)	-0.5 (1.7)
	M3	-33.4 (7.6)*	0.84 (0.02)*	0.02 (0.02)			7.8 (2.0)*	2.1 (2.4)	2.4 (3.1)	-0.7 (1.7)
	M4	-33.2 (7.3)*	0.84 (0.02)*	0.02 (0.02)	-30.7(4.9)*	22.7(7.0)*	5.3 (1.9)*	0.4 (2.2)	1.8 (3.0)	-1.8 (1.7)

Note: EAS = Emphasis on Academic Success; SOS = Safety and Orderliness of School; CTS = Confidence in Teaching Science; IES = Instructional Engagement of Students; UAE = United Arab Emirates.
(): Standard errors appear in parentheses. *p< .05

Discussion and Conclusion

Instructional written materials play important roles as teachers' agents in effective teaching practices. Workbooks and worksheets are one of the most frequently used materials (Table 1). Based on the result of this study, the association of worksheet usage and science achievement is found to be quite different across

countries. To sum up the result, there are five types of relationships among science achievement, worksheet usage, and other related variables (Table 3).

- Type 1: The association between WB and SA remains the same regardless of whether or not teacher and school variables are controlled, and no interaction is present between WB and LR in SA.
- Type 2: The association between WB and SA depends on whether or not teacher and school variables are controlled, and no interaction is present between WB and LR in SA.
- Type 3: The association between WB and SA remains the same regardless of whether or not teacher and school variables are controlled, and a positive interaction is present between WB and LR in SA.
- Type 4: The association between WB and SA remains the same regardless of whether or not teacher and school variables are controlled and a negative interaction is present between WB and LR in SA.
- Type 5: The association between WB and SA depends on whether or not teacher and school variables are controlled, and a negative interaction is present between WB and LR in SA.

In addition, there is no significant interaction between WB and RA in all participating countries.

Table 3: Relationships among worksheet usage, science achievement, and other variables

Type	Association btw WB & SA after controlling variables		WB*LR	Country
	No	Teacher and school variables		
1a	~S	~S	~S	Austria, Azerbaijan, Croatia, Czech Republic[a], Georgia, Hong Kong, Hungary, Iran, Ireland, Lithuania, Oman, Poland, Portugal, Romania, Russian Federation, Slovak Republic, Slovenia, Spain, Sweden, Taiwan
1b	N	N	~S	Northern Ireland
1c	P	P	~S	Saudi Arabia
2a	N	~S	~S	Singapore
2b	~S	N	~S	Germany
3a	~S	~S	P	Australia, Finland, Morocco, Norway
3b	N	N	P	Qatar, United Arab Emirates
4	N	N	N	Italy
5	N	~S	N	Malta

Note: ~S = Not significantly different from zero; P = Significantly positive; N = Significantly negative.
[a]: Although the association between WB and SA is significantly different from zero, none of the teacher and school variables are significantly related to SA.

Based upon the above findings, there are four directions of further investigation to identify important features of designing and applying worksheets through comparisons across countries in future studies.

Firstly, the international comparison can be made among three groups of countries to identify the related factors in predicting science achievement. In most countries, there is no association between WB and SA, including countries of type 1a and 3a. Only in Saudi Arabia is the association positively different from zero. In the four countries of type 1b, 3b, and 4, the association is negatively different from zero.

One explanation of the negative association between worksheet usage and science achievement is that teachers tended to use worksheets in low-achievement classes, as Reid (1984) reported. If this is true, teachers' perceptions of class achievement may be the cause of the negative association. However, after the introduction of the variable of classes' lack of readiness in Model 4, the association in the four countries, Northern Ireland, Qatar, the United Arab Emirates, and Italy, remains the same (Table 2). Consequently, there are other factors that have yet to be uncovered.

The second direction of future investigation is the relationship between worksheet usage and other teacher and school factors. After controlling the teacher and school variables, EAS, SOS, CTS, and IES, for type 2 and 5 countries (Singapore, Germany, and Malta), the association between WB and SA changed. For Singapore, the variable EAS is significantly related to SA in Model 2. For Germany, the significantly relative variables are EAS and IES. For Malta, the relative variables are EAS, SOS, CTS, and IES (Table 2). These results imply that these teacher and school variables, worksheet usage, and science achievement are correlated in these countries.

It is worth inquiring why these teacher and school variables and worksheet usage are correlated and how they together influence students' science achievement.

Thirdly, the mechanisms that make worksheets more effective for students in classes lacking readiness than those in classes not lacking readiness are worth looking at further. It would be easier to find out the mechanisms through the use of data from countries of type 3 (Australia, Finland, Morocco, Norway, Qatar, and the United Arab Emirates), which have positive interactions between WB and LR in Model 4 (Table 2). Data from Italy and Malta could also be used as contrast. To find the mechanisms, more data about worksheet design and about teaching and learning with worksheets should be collected. For example, strategies that students use to complete worksheets are important factors related to their achievement but are not well documented.

The last direction of further inquiry is identifying the factors that result in no interaction between worksheet usage and reading achievement in science achievement. The result of no interaction between WB and RA may be caused by appropriate matching of language levels of worksheets with students' reading abilities, but it might also be caused by teachers' explanations before students starting to work on worksheets. The data collected by TIMSS and PIRLS 2011 cannot help us to identify the cause. To resolve this problem, data about evaluation on language demand of worksheets and the teaching methods accompanying worksheets need to be collected.

Acknowledgements or Notes

The author wish to thank the project (NSC 101-2511-S-003-021) funded by National Science Council of Taiwan.

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