

Research on vocabulary competency of key subjects and PISA-type knowledge application competency

By CRET (Center for Research on Educational Testing)

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Language is at the root of learning various subjects and is one of the components essential for classroom teaching. Vocabulary is a basic element of language. There is vocabulary common to different subjects taught at school as well as unique vocabulary for each subject.

The objective of this research is to clarify the relationship between vocabulary acquisition of each subject and competency to use the acquired knowledge. CRET has independently developed two types of tests for assessing vocabulary competency and knowledge application competency of four key subjects: arithmetic/mathematics, Japanese, science, and social studies. As a part of a 2007 preliminary study, a survey was conducted in January and February of 2008 on fifth graders and eighth graders.

1 . Outline of survey

All test booklets consisted of 24 items on vocabulary and 2 major items on application competency. In order to equate different versions of the tests for different subjects, both vocabulary and knowledge application competency tests were designed to include common items.

For the entire knowledge application competency test in arithmetic/math, constructed-response items were used. For the other three subjects, both constructed-response and objective multiple-choice formats were used.

As for the source materials used for knowledge application tests, school and life scenes to which children are exposed in their daily life were carefully chosen, so that there was no impartiality among the examinees

The vocabulary tests for four subjects were all based on multiple-choice items with five response options. The number of examinees tested was around 100 for each test booklet.

Definitions of vocabulary competency and knowledge application competency:

- Vocabulary competency
: The ability to comprehend and make use of terms that may possibly prevent or slow down the mastery of the subjects.
(All vocabulary items are in the multiple-choice form with five response options)
- Knowledge application competency
: The ability to comprehend and make use of terms that may possibly prevent or slow down the mastery of the subjects.
(All vocabulary items are in the multiple-choice form with five response options)

2 . Data analysis and results

The result of the data analysis indicated that many high performers in vocabulary tests for four subjects did not score high in knowledge application tests. Low performers in vocabulary tests tended to score low in knowledge application tests. When scores from different versions of the test were equated, the estimated scores of vocabulary and knowledge application tests clearly indicated the tendency for vocabulary competency to be a necessary condition for scoring high in knowledge application tests of all four subjects.

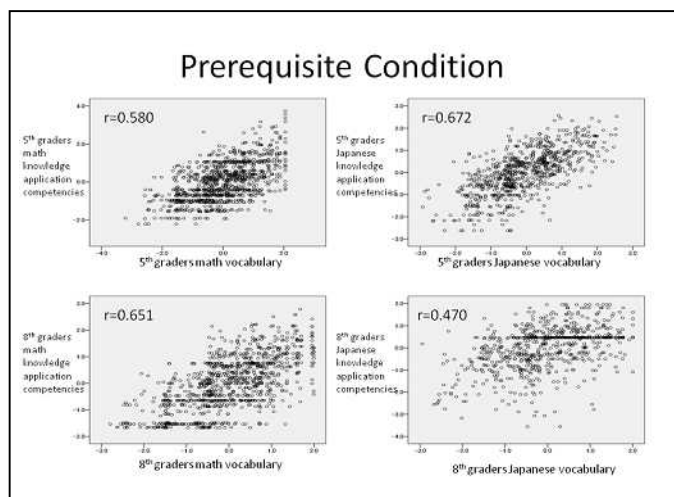
On the one hand, this tendency was most conspicuous in the application tests for elementary school arithmetic vocabulary and application competency; the correlation between these tests was $r=0.58$. On the other hand, it became less apparent in elementary school Japanese ($r=0.67$). As for science and social studies, the degree of importance as a prerequisite condition for scoring high in application test came in between arithmetic/math and Japanese.

For the entire vocabulary tests for four subjects that we have developed, the outcome showed a high correlation between high discrimination items and the ability to correctly answer individual questions in application items. On the other hand, low discrimination items have a weaker relationship with the ability to give correct answers to application questions.

3 . Observation

The outcome of the survey did not seem to show a high correlation between vocabulary and application competency of each subject. However, considering the reliability of each version of the tests, the correlation after modification went up to around 0.8. Also taking into account the prerequisite condition, we can presume the possibility of a higher correlation between the vocabulary and subject tests.

Judging from each test booklet, we observed a general tendency for a higher correlation between the total scores for the test with better measurement accuracy. When the ceiling effect of the vocabulary test is considered, the true correlation between vocabulary and knowledge application competency of each subject could probably be higher than the results shown in the data analysis.



The correlation between vocabulary test scores and knowledge application test scores (arithmetic and math)

Correlation coefficient between vocabulary test score and application test score (5th grader math)

Application skill test booklet	MK12	MK13	MK14	MK23	MK24	MK34
Vocabulary test booklet	MSV	MSV	MSV	MSV	MSV	MSV
Before correction	0.476	0.480	0.567	0.549	0.502	0.574
After correction	0.791	0.840	0.873	0.862	0.859	0.925

Correlation coefficient between vocabulary test score and application test score (9th grader math)

Application skill test booklet	MK57	MK68	MK58	MK67
Vocabulary test booklet	MCVA	MCVA	MCVB	MCVB
Before correction	0.647	0.585	0.602	0.604
After correction	0.901	0.894	0.885	0.879

The correlation between vocabulary test scores and knowledge application test scores (Japanese)

Correlation coefficient between vocabulary test score and application test score (5th grader Japanese)

Application skill test booklet	JK13	JK24	JK14	JK23
Vocabulary test booklet	JSVA	JSVA	JSVB	JSVB
Before correction	0.725	0.641	0.613	0.647
After correction	0.973	0.932	0.898	0.906

Correlation coefficient between vocabulary test score and application test score (9th grader Japanese)

Application skill test booklet	JK58	JK67	JK57	JK68
Vocabulary test booklet	JCVA	JCVA	JCVB	JCVB
Before correction	0.478	0.328	0.554	0.557
After correction	0.853	0.701	0.835	0.849

4 . Conclusion

The degree to which vocabulary competency is prerequisite to knowledge application competency is highest for math, which is followed by science and social studies. Japanese ranked the lowest.

This result may be due to the characteristics of test items in each subject. Another interpretation derived from the above order is due to the characteristics of the subjects themselves. The lower the amount of vocabulary required for mastery of a subject is, the higher the prerequisite relation is.

We cannot expect students to readily improve their ability to apply knowledge simply by enhancing the acquisition of the necessary vocabulary. Nevertheless, it is also difficult to expect students' scholastic competency to grow without sufficient comprehension of the vocabulary used in each subject. This survey indicated that a sufficient understanding of the vocabulary in each subject taught in school is essential for the academically challenged.