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USE OF QUESTIONNAIRES TO ASSESS IMAGERY ABILITY IN CHILDREN: AN EXAMINATION OF THE VALIDITY WITH *KANJI* GRAPHEME INTEGRATION TASK

By

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A total of 211 third, fourth and sixth grade children and 48 undergraduate students participated in the *Kanji* (Chinese character) grapheme integration task (KGIT) similar to Sasaki & Watanabe (1983) developed. The task presented subjects with two or three graphemes of a *kanji* under either visual or auditory presentation mode and asked them to identify the original *kanji* that can be formed with them. The performance was analyzed by means of the Questionnaire upon Mental Imagery (QMI) and the Test of Visual Imagery Control (TVIC). In the case of children, the imagery tests were modified by the author. High imagers classified by the QMI were superior to low imagers both for children and adults, especially under the auditory presentation mode and with difficult *kanji*. TVIC did not predict the performance well, though some relation was revealed in fourth grade. The differences of the predictive efficiency of both tests were considered according to the imagery properties that KGIT presumed to require subjects to solve the problem. Imagery questionnaire tests were recommended to clarify individual differences in children and to search for the origin of imagery differences developmentally.

Key words: imagery ability, individual differences, school children, *Kanji* grapheme integration task, imagery questionnaires, Questionnaire upon Mental Imagery, Test of Visual Imagery Control.

Imagery ability is known to predict the performances of various tasks where imagery process is presumed to function (e.g., Ernest, 1977; White, Sheehan, & Ashton, 1977). Imagery ability, however, is not simple, so the way of predicting the performance varies with the nature of the task (Hatakeyama, 1982).

The methods to assess individual differences of imagery ability are classified into two groups. One group measures subjective aspects of imagery by using questionnaires. The shortened version of Betts QMI, for example, requires subjects to rate the vividness of their images of seven modalities (Richardson, 1969; Sheehan, 1967). The VVIQ also requires to rate the vividness of visual images (Marks, 1973). Gordon TVIC assesses the controllability of visual imagery (Gordon, 1949; Richardson, 1969). Another group is the test of objective type that uses spatial tasks. Some aptitude tests

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of paper and pencil type, such as Flags (Thurstone & Jeffrey, 1959), MPFB (Likert & Quasha, 1970), and Space Relations (a subtest of the Differential Aptitude tests: Bennett, Seashore, & Wesman, 1974), are often used as imagery tests.

A controversy was aroused between Kaufmann (1981, 1983) and Marks (1983) over the validity of imagery questionnaires. Kaufmann (1981, 1983) proposed that the questionnaire approach is infected by a methodological flaw, due to differences in subjective conceptions of the rating scale, and recommended to employ objective tests. Marks (1983) defended the self-report technique by referring various examples that show its validity. In this context, we can think of Paivio (1978a, b) who adopted only objective tests in analyzing the relation of imagery ability to performances on tasks, though he administered also two questionnaire type tests in his research. The main reason was that responses to imagery questionnaires were essentially uncorrelated with the performances on objective tests.

Having in mind that imagery process is not simple, as Kosslyn's (1980) and Farah's (1984) models showed plainly, we cannot easily take part with either of the both approaches. The uncorrelation between scores of subjective and objective tests reveals in itself the complexity of imagery process. Imagery ability must be multifaceted. So we should conceive that both types of tests, and also individual tests included in each of them, measure different aspects of imagery. Therefore, we should not simply anticipate that any imagery test can predict the performance of a cognitive task even if imagery process is expected to proceed in the task.

For instance, as Hatakeyama (1981) made clear, the Flags predicted the level of performance on the task that requires mental rotation after a stimulus is presented (*post*-stimulus rotation task), while the Space Relations predicted the performance on the task that requires the rotation before the stimulus is presented (*pre*-stimulus rotation task), though both are equally called mental rotation tasks. For another instance, in Hatakeyama (1984), the QMI predicted well the performance level of two mental size comparison tasks, an object task and a clock task, but objective tests did not. In these tasks of mental rotation and mental comparison, imagery process is presumed to work. The reason why the imagery tests differ in their efficiency to predict the performances is that imagery process varies with tasks. As Denis (1991) anticipated, an imagery test can be valid if it corresponds to that aspect of imagery being investigated (p. 32).

There are various aspects in imagery ability, as we have seen above, and the tasks that are related to it are diverse. Studying the individual differences of such imagery ability in children will be helpful for illuminating the problem of origin of individual differences in imagery ability. In particular, subjective aspects of imagery is expected to be clarified through study on children. Objective tests are naturally of value to be studied in their own way. But, even if any relation is observed between some objective test and some cognitive task, we cannot easily attribute the relation to imagery ability. We must accept the fact that what objective tests actually measure is unclear, as Hishitani (1984) pointed out. A possibility remains that so-called general intelligence or spatial ability might be able to interpret well the relation, because the objective tests are usually diversions from tasks of intelligence tests or aptitude tests. Needless to say, it is possible to examine the relation by deducting the factor of intelligence with a matched pair technique. However, there is another essential problem. To what extent does the imagery ability measured by objective tests reflect the imagery in a usual sense, that is, the imagery which is represented and been aware in time of absence of stimulus object ? We must notice that there is a vast and important area for studying imagery that will not be able to be grasped through the ability of spatial operation, if we think of the very little correlation between subjective and objective test scores.

Are there any individual differences even in childhood concerning subjective vividness of imagery ? What differences are there among children concerning subjective controllability of imagery ? If several kinds of subjective tests are administered to children, the scores would distribute in their respective ways. Do such distributions have any definite relation with cognitive tasks ? If such relations are found, further investigation should be planned because subjective aspects of imagery seems to reflect the function of imagery even in children. If there is not any relation at all, we must assume that estimations by children are not reliable, or we must recognize that measurement of imagery based on their own introspections is meaningless in children.

There have been few researches that examined imagery ability in children by using a self-report technique. First, subjective imagery tests for children have not been developed yet. Besides, we have some doubts whether a child is able to evaluate accurately their inner phenomenon like imagery. As to this problem, we can see a research by Shaw and deMers (1986–87) that investigated the relation between three measures of imagery, including VVIQ and TVIC, and three creativity tests in 5th and 6th grade children of high IQ and of average ability, and suggested a positive relation in high-IQ children. From their research, we recognize that imagery questionnaires can be successfully administered to children of 5th grade and above, and that their response to the questionnaires can have some validity at least for gifted children of those grades. We can cite another research on meta memory in which subjective judgments of children themselves on their memorization ability and memorization strategy have been used (e.g., Kreutzer, Leonard, & Flavell, 1975). We may hope that it is not impossible to give subjective imagery tests to children and that their self-evaluation need not always regarded as unreliable. Determining the lowest age of children whom subjective imagery tests could be applied, however, will be an important problem.

The present research aimed to examine the possibility of use of subjective imagery tests and the validity of such tests in children. We used questionnaires of QMI and TVIC, which were modified for children by the author, and analyzed their relation to *Kanji* (Chinese character) grapheme integration task (KGIT) as Sasaki and Watanabe used (Sasaki, 1984 ; Sasaki & Watanabe, 1983, 1984). The KGIT is the task Sasaki and Watanabe (1983) developed to study "kūsho" (空書, writingresembling finger movement) behavior that often happens among Japanese along with effort for recalling a character. The task presents subjects two or three graphemes that compose a *kanji* and asks them to identify the original *kanji* that can be formed with them. Imagery process is supposed to help the subjects solve the problem in KGIT, because the graphemes must be retained and combined in the mind to form a *kanji*. In fact, imagery process in soving the KGIT was reported by the introspection of subjects in Sasaki and Watanabe (1983) : they had subjects to rate the vividness of grapheme images and ease of operation of the images, though the ratings were not used to relate the scores of their performances. On the basis of such research, self-report imagery tests are expected to be efficient in predicting the performance on the KGIT. By way of parenthesis, using the backward spelling and word completion tasks of English word, Sasaki and Watanabe (1984) found that the appearance of "kūsho" behavior is peculiar to the *kanji* culture areas of Japan and China.

The third, fourth and sixth grade children and university students were used as subjects in our present research. University students would be reliable in their response to the subjective imagery tests. Therefore, their results would be useful in examining the reliability of the results of children.

Both visual condition and auditory condition were used as the presentation method of graphemes in KGIT. The auditory presentation condition was supposed to involve more imagery process than the visual condition, because, in the former, the graphemes themselves must be visualized in mind before combining them to identify a target *kanji*.

The presentation order of some of the graphemes was changed from the normal order in hand-writing a *kanji*, and others were presented in the normal order, which constituted one factor in analyzing. The changed order of presentation would be more difficult. The difficulty of *kanji* according to the arrangement patterns of graphemes was also included in analysis as a factor. Sasaki (1984) found that *kanji* with an arrangement pattern of the top-bottom type (e.g., 立, 日→音, sound) and left-right type (e.g., 言, 売→読, read) were identified better than the surrounding type (e.g., 口, 玉→国, country) and three-grapheme type (e.g., 十, 早, 月→朝, morning).

How will the QMI and TVIC predict the performance of KGIT ? The task of KGIT expects subjects to form the images of graphemes and to hold them to compose into a *kanji*. QMI assesses the ability to form images vividly, taken at its face value. Kosslyn (1980) proposes that the vividness would correspond to the amount of detail or to the quality of the image, and one of the factors of it would be the length of time the visual buffer could retain a charge (hold the image) before refreshment (p. 400). Denis (1991) also indicates that vividness is a function of the frequency with which features are activated in the configuration of an object (p. 109). If vivid imagers can form images actually vividly, either based on their long-term memory or on the stimuli presented visually, and hold them vividly, they would be more advantageous in KGIT than low imagers. The advantage would be greater under the auditory presentation condition, with the changed order presentation, and on the complex *kanji*, where subjects would rely more on imagery. On the other hand, TVIC requires subjects to control images. The control is attained, in this test, by replacing a previously formed image with a new one regarding an automobile. Composing the images of graphemes into a *kanji* in KGIT must be a kind of control, but KGIT task would require subjects to visualize and hold images more and to replace images less. Therefore, TVIC would not show a relation to the performance so well.

METHOD

Subjects: The subjects analyzed were 74 3rd grade, 73 4th grade and 64 6th grade children in the Elementary School affiliated to the Faculty of Education, Yamagata University, and 48 university students of that faculty.

Materials: Twenty-four test items were prepared for 3rd grade and 4th grade pupils, and twenty-eight items for 6th grade pupils. Thirty items were prepared for the university students, adding two items to those for 6th grade subjects. For the school children, *kanji* (Chinese characters) that are allotted to be learned in the preceding grades were used as a rule, though some of the *kanji* were those that had been already learned at their respective grades. Thirteen items of the task were common to all subjects. The *kanji* used in the experiment can be classified into eight categories according to the spatial arrangements of the graphemes (Table 1).

Procedure: One class of children in each grade was assigned to the visual presentation condition, another class to the auditory presentation condition. The experiment was carried out in a class group. In the former condition, each of the graphemes was presented on the central range of 14×16 cm in a sheet of Kent paper of 15.3×36.0 cm size. In the latter condition, an experimenter presented each grapheme orally. The presentation order of the graphemes was either the same as the

Table 1. *Kanji* materials used in the experiment

Grade	Two-grapheme††			Three-grapheme				
	Top-bottom	Left-right	Surrounding					
All	思星買歩	絵晴校読	国回†		昭†語	朝†		
3rd	名岩音男	鳴理時明	目日				意	
4th	童岩員息	畑柱終動	目日				章	
6th	票志舌貧	現妹銅破	因固	賀	総	歌	量†	謝†
Students	票志舌貧	現妹銅破	因固	聖†賀	総	歌	量†貴	謝†

† Presented in normal order.

†† *Kanji* of the left half row of each category that belongs to the two-grapheme type were presented in normal order.

normal order of making strokes in writing or different from the normal order. After making subjects write their names on the cover sheet of a booklet for responses, the following instruction was given. "Let's do a *kanji* quiz game now. The *kanji* of 'hayashi' (林, grove) is made of two 'ki's' (木, tree) standing side by side. (The experimenter writes the characters on the blackboard.) Many *kanji* are made of several *kanji* as in this case. I'll show (tell) you the *kanji* that compose one *kanji* when they are combined. In some cases, I'll show you two *kanji*. In other cases, three *kanji*. Try to identify the one target *kanji* which will be composed by combining them. Write it on a page of the notebook (booklet) if you can see what it is. The order of the presentation of *kanji* is in the normal order in writing in some cases, but in other cases in a different order." After giving two exercise trials and explanations, test trials were made. The interval of grapheme presentations was about three seconds. The subjects responded with a call of signal. The time given to subjects for responding was 20 seconds. After the KGIT, imagery tests were carried out in the order of QMI and TVIC.

Imagery tests : Two questionnaires, QMI and TVIC, were employed. The QMI was composed of 35 items, five items in each of seven sensory modality, with a five-point rating scale, modified for children by the author modeling on the shortened version of Betts QMI (Richardson, 1969 ; Sheehan, 1967). The TVIC was of 12 items using a method of two-category, modified for children by the author modeling on Gordon TVIC (Richardson, 1969). The experimenter gave the tests to children in a group of class while reading aloud the test items. The presentation interval of the items was about 8 seconds. The university students completed the original versions of the tests at their own pace : QMI with a seven-point scale, and TVIC with a method of three-category including "unsure."

Results and Discussion

Imagery Tests

The means and standard deviations of QMI and TVIC are presented in Table 2. As for QMI, response of the most vivid image was awarded 1 point and that of the poorest image 5 points. In the case of university students, the poorest response was 7 points according to a seven-point scale. The average in children was 1.83, which was relatively more vivid as a whole in comparison with 2.07 of the students, calculated by correcting the scoring with a seven-point scale into a five-point scale. It is unclear whether such a result would be gained consistently in children, or whether this was due to the vividness of image inherent in developing children or due to subjects' bias toward social desirability (Di Vesta, Ingersoll, & Sunshine, 1971 ; White, Sheehan, & Ashton, 1977). Further research is needed to solve the problem.

As for TVIC, a positive response by children was scored as 1 point and a negative response as 0, while, in the case of the students, 2 points were given to a positive one

Table 2. Means and standard deviations of imagery tests

		3rd	4th	6th	Students
QMI††	Male	69.77 (25.55)†	62.97 (18.84)	63.19 (20.75)	94.43 (20.04)
	Female	62.90 (19.43)	61.75 (18.42)	64.24 (18.55)	88.93 (25.23)
	Total	66.15 (22.79)	62.37 (18.65)	63.73 (19.66)	91.33 (23.27)
TVIC†††	Male	8.74 (2.96) △	9.32 (2.21)	10.10 (1.89) △	19.00 (4.07)
	Female	9.85 (2.34) △	9.08 (2.86)	9.18 (2.12) △	18.96 (4.29)
	Total	9.32 (2.71)	9.21 (2.55)	9.63 (2.07)	18.98 (4.20)

† Figures in parentheses are standard deviations.
†† Five-point scale for children and seven-point scale for students.
††† Method of two-category for children and three-category for students.
△ $.05 < p < .10$ (t-test)

and 1 point to the response of "unsure." The average of the children was 9.39, which was not so different from the average of 9.49 of the students, when the scoring of the latter was corrected into the former case. The results of children in TVIC showed reliability so far as the average points are concerned. The correlation coefficients between these two tests were .52 for the 3rd grade, .39 for the 4th grade, .43 for the 6th grade and .25 for university students. Those for the children were relatively larger than that of students.

It is clear that QMI and TVIC used here can be administered to elementary school children of the 3rd grade and the above grades. The characteristics of children's responses to the imagery tests, however, should be examined more fully.

The *Kanji* Grapheme Integration Task

The scores of the *Kanji* grapheme integration task (KGIT) were better in the visual presentation condition than in the auditory condition in children of all grades, as shown in Table 3. As for the presentation order, contrary to our expectations, the normal presentation order did not necessarily result in a better performance than the changed order. A two-way analysis of variance of presentation mode × presentation order, with repeated measure on the second factor, was made on the percentage scores of the original ones. It revealed a significant interaction in the 6th grade, $F(1, 62) = 5.07$, $p < .05$. The changed order resulted in higher scores in the auditory condition. (Also in the 4th grade, the changed order of presentation tended to result in better performance, though the difference was not significant, $F(1, 71) = 2.79$.) Of the *kanji* presented in the normal order and those presented in the changed order, whether the *kanji* in one of these categories was generally more complex or not is unclear. Subjects might have been anticipating the appearance of graphemes in changed order

Table 3. Mean proportions of correct responses to the KGIT

Grade	Presentation mode	Top-bottom	Left-right	Surrounding	Three-grapheme	Normal order	Changed order	Total
3rd	Visual	89.5	90.9	62.8	70.3	82.3	82.3	82.3
			*		**	*		*
	Auditory	85.1	82.1	65.0	52.8	74.2	76.2	75.1
4th	Visual	87.9	99.3	82.8	72.8	87.7	89.1	88.3
			***		***	**	*	**
	Auditory	89.8	84.5	77.8	52.0	77.9	81.8	79.7
6th	Visual	88.9	97.5	82.3	79.6	88.9	86.4	87.8
		***	***	***	***	***	***	***
	Auditory	74.1	87.1	24.3	48.8	61.1	66.1	63.4
Students	Visual	93.3	99.0	63.5	74.6	82.2	87.4	84.6
			**		***	*	***	***
	Auditory	90.4	94.4	50.0	58.2	74.8	76.0	75.3

* $p<.05$ ** $p<.01$ *** $p<.001$ (t-test)

in the experiment.

When we observe the arrangement pattern of graphemes, *kanji* of the top-bottom type and left-right type were identified more easily than those of the surrounding type and three-grapheme type as in Sasaki (1984), as shown in Table 3. A two-way analysis of variance of presentation mode × difficulty of characters (according to the arrangement patterns), with repeated measure on the second factor, on the percentage values, revealed significant main effects of difficulty of characters in all grades (3rd: $F(1,72)=99.52$, $p<.001$; 4th: $F(1,71)=81.41$, $p<.001$; 6th: $F(1,62)=246.26$, $p<.001$; students: $F(1,46)=264.28$, $p<.001$) and significant interactions in 6th grade pupils, $F(1,62)=66.02$, $p<.001$, and in university students, $F(1,46)=9.76$, $p<.005$. The difference of the effects of difficulty of characters was larger under the auditory presentation. We recognize here that the factors of presentation mode and degree of difficulty of *kanji* must be given special attention in the following analyses on the relation of KGIT performance to the imagery ability.

The KGIT and Imagery Ability

Dividing subjects in each grade into high (H) imagers and low (L) imagers by the scores of each imagery test, a two-way analysis of variance of presentation mode × imagery ability, and two three-way analyses of variance of presentation mode × imagery ability × presentation order and of presentation mode × imagery ability × *kanji* difficulty, with repeated measures on the third factors, were carried out. As for the QMI, in the 3rd grade, significant main effect of imagery ability was

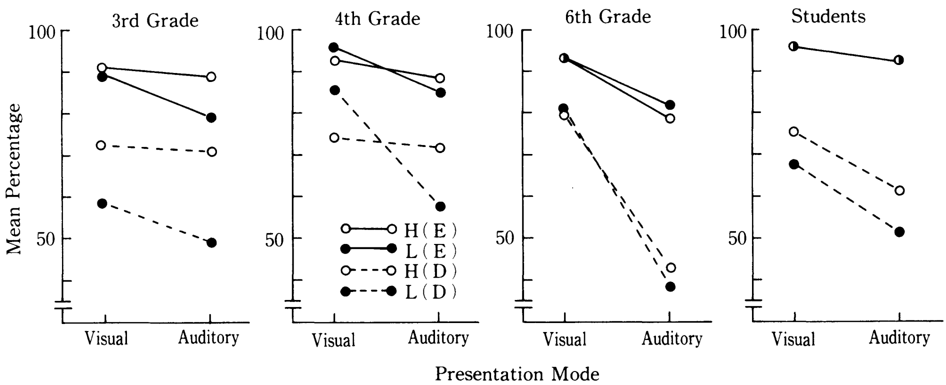

Fig. 1. The mean performances of the KGIT of high imagers (H) and low imagers (L) classified by QMI. The means are calculated on each of the easy (E) and difficult *kanji* (D) under each of the visual and auditory presentation modes.

revealed, $F(1, 70)=8.18$, $p<.01$. As shown in Fig. 1, the H group was superior to the L group irrespective of the presentation mode. Also, the factor of *kanji* difficulty showed a significant interaction with the imagery ability, $F(1, 70)=6.82$, $p<.05$. As seen in Fig. 1, the difference of imagery ability appeared more clearly in difficult characters, which supports our expectation.

In the 4th grade, a significant interaction of presentation mode $\times$ imagery ability was observed, $F(1, 66)=5.68$, $p<.05$. We can see in Fig. 1 that the L group received a great influence from the presentation modes: L group was superior to the H group under visual mode and inferior under auditory mode. This is consistent with our expectation, except the superiority of L group in visual presentation mode. Moreover, both three factors revealed significant interactions, $F(1, 66)=4.35$, $p<.05$; $F(1, 66)=5.11$, $p<.05$. The interactions were indebted to the normal presentation order and to the difficult characters. As for the former case of presentation order, L group was disadvantageous on the normal presentation order under the auditory mode. This may be that the normal order was more difficult (it was tended to be worse than the changed order in the 4th grade) and the L group was inferior to the H group on that order under the auditory mode. Or it may be that the L group was ready for changed order excessively in the experiment, so resulted in inferior performance on the normal order under the auditory condition, because their poor imagery could not cope with the unready order well according to the auditory informations. Either interpretation is not against our expectation. As for the latter case of difficulty of character, L group was disadvantageous on the complex character of the surrounding type and three-grapheme type under the auditory mode, which supports our expectation.

In the 6th grade, a tendency for an interaction of imagery ability $\times$ presentation order was observed, $F(1, 60)=3.08$, $.05<p<.10$. L group was influenced by the presentation order of graphemes, that is, worse with normal order and better with changed order, while H group was not influenced. Interpretation of this may be similar to the case of 4th grade. That is, H group performed equally well in the more difficult presentation order of normal one (the normal order was worse than the changed order in this grade, too), or L group was too ready for the changed order to cope with the unanticipated order well by their poor imagery. Either interpretation may accord with our expectation.

A tendency toward main effect of imagery ability was observed in university students, $F(1, 44)=3.35$, $.05<p<.10$. Also there was a significant interaction of imagery ability × *kanji* complexity, $F(1, 44)=5.91$, $p<.05$. The H group was superior to the L group with the difficult characters, but not with the easy ones. This result is tending to support our expectations.

As we have seen, for QMI, H group was superior to L group in the 3rd grade, 4th grade (and possibly 6th grade, though partially) children and university students. The predictive efficiency of QMI on KGIT performance was great especially under the auditory presentation mode and with complex characters. Subjects with vivid imagery were less influenced by the presentation mode and by the presentation order of graphemes, while those with weak imagery were disadvantageous in auditory presentation mode and on complex characters that would rely more on imagery. It should be noticed that the low imagers are inferior in the process of forming images rather than in holding them, that is, in forming images in the absence of stimulus object (e.g., according to auditory information), and that such inferiority becomes more apparent in a difficult problem (e.g., a complex character). We can say that vividness of images is not a mere epiphenomenon but it has substantial functions.

As for the TVIC, in children, only the 4th grade children showed positive relation to the KGIT. A significant interaction of presentation mode × imagery ability was found, $F(1, 69)=7.39$, $p<.01$. As is shown in Fig. 2, L group was influenced much by

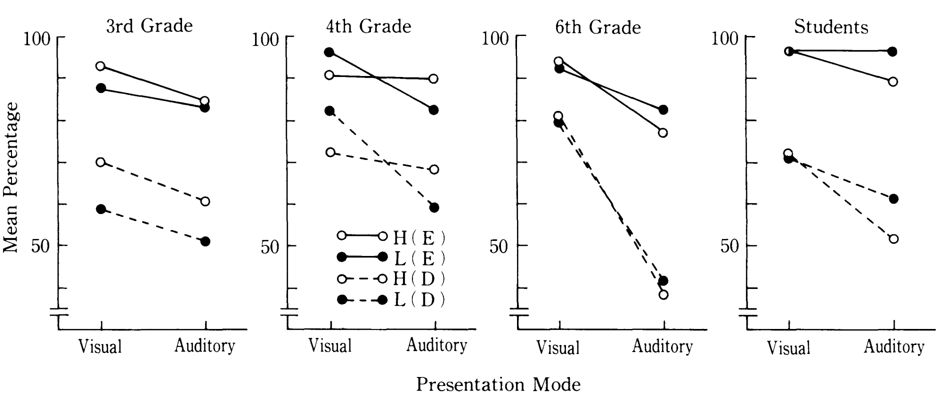

Fig. 2. The mean performances of the KGIT of high imagers (H) and low imagers (L) classified by TVIC. The means are calculated on each of the easy (E) and difficult *kanji* (D) under each of the visual and auditory presentation modes.

the presentation mode, that is, better in the visual presentation mode and worse in the auditory mode, while the auditory mode was not disadvantageous for H group. Also a tendency toward an interaction of imagery ability $\times$ presentation order was observed, $F(1, 69)=3.27$, $.05<p<.10$. H group did not differ between both orders, while L group was worse with the normal order and better with the changed order. These results of 4th graders indicate the predictive efficiency of TVIC, which we did not expect in advance. The predictive relation was apparently similar to the case of QMI. Therefore, we may give similar explanations by substituting imagery controllability for imagery vividness. But, why does the controllability have a relation to KGIT? If the correlation of TVIC and QMI could explain the results of 4th grade (.39), why were similar results to QMI not found in 3rd grade (.52) and in 6th grade (.43)? As for the interaction between presentation mode and imagery ability, it could be said that ability to form images, whether vividly or not, was reflected. That is, pupils who were good at forming images were less disadvantageous under the auditory mode. As for the interaction between imagery ability and presentation order, similar explanation that such pupils were better on more difficult presentation order, i.e., normal order, may be given. We may give another explanation to this case by referring to the controllability. The low-control imagers might have been too ready for changed order of presentation to deal flexibly the unexpected normal order. It is notable that Gordon (1949), a developer of the TVIC, found that subjects with "autonomous" (low-control) imagery have a tendency to form "stereotyped" (rigid and change-resisting) images to the names of national groups.

For the university students, a tendency for an interaction of presentation mode $\times$ imagery ability was found, $F(1, 44)=3.54$, $.05<p<.10$. As seen in Fig. 2, unaccountably, H group was worse than L group under the auditory presentation mode, while L group did not differ between the two modes. The predictive directions of TVIC on KGIT were thus opposite between the 4th grade children and the students.

The relation of TVIC to the KGIT was not found extensively in children, and the relation in adult was unexplainable, dissimilar to the case of QMI. Therefore, it might be sufficient here to tell that TVIC is not so suited for the prediction of KGIT performance, though a possibility remains that it has some predictive efficiency in the case of children. TVIC must be unfavorable for KGIT, because it is a test that demands subjects to control images by replacing an image by a new one rather than to hold them. If it assessed controllability of imagery by requiring subjects to manipulate images while holding them, it could have a predictive efficiency for the KGIT.

To sum up, the 3rd grade, 4th grade (and possibly 6th grade, though partially) children showed positive relations with the KGIT for QMI. This finding was supported by the university students who revealed similar relations for QMI. The 4th grade children showed probably some prediction also for TVIC, but this was not supported by the students. We can confirm that subjective imagery tests can have predictive efficiency in children, if the test estimates the common aspects of imagery with tasks.

Use of imagery questionnaires is thus given further validity by the present research on children. When such tests predict more tasks in children, the availability of imagery questionnaire tests in them will be established more firmly. Moreover, we can recognize that there are individual differences in imagery vividness for children of 3rd grade. A new problem concerning the origin of individual differences in imagery ability will be set here. We can cite several researches in relation to this subject. Levin et al. (1974), on 4th grade children, could successfully classify the types of good picture learners and poor picture learners by determining whether or not they learned relatively better from pictures than words. Riding and Taylor (1976) and Riding and Calvey (1981), on children aged seven and eleven, respectively, showed the coding styles of imagery type and verbal type by calculating ratios of response latencies to questions. These are important and excellent researches but did not treat subjective aspects of imagery. The use of imagery questionnaires should be recommended as an important method to clarify imagery differences in children more fully and to search for the origin developmentally.

The 6th grade pupils did not show a marked relation with the task. One reason may be that the experiment was administered around the end of the second semesters and they were in the middle of practicing *kanji* for the coming entrance examination for the Junior High School affiliated to the Faculty of Education of Yamagata University. Another may be that the complex *kanji* were too difficult for them under the auditory presentation mode. Therefore, it is probable that imagery ability could not effect the performance in them.

Conclusion

The present research investigated the validity of subjective imagery tests in 3rd, 4th and 6th grade children, by analyzing the predictive efficiency on the *Kanji* grapheme integration task (KGIT). Two imagery tests of QMI and TVIC, which were modified for children by the author, were used to assess imagery ability. The results of undergraduate students were also used to examine the reliability of those of children. The principal findings are as follows.

1. The average of the QMI in children revealed relatively more vivid images than in students. It is unclear whether such a result would be gained consistently in children.

2. The average of the TVIC in children differed little from that of the students.

3. QMI predicted the performance of KGIT. The high imagery group was superior to the low imagery group in 3rd grade, 4th grade (and possibly 6th grade, though partially) children and in the university students. The predictive efficiency of QMI was greater under auditory presentation mode than visual presentation mode and greater with more complex characters.

4. TVIC did not predict the performance well, though some relation to the task

was revealed for 4th grade pupils.

5. It was clarified that subjective imagery tests can be administered to school children, and that they can have predictive efficiency on tasks, if the tests estimate the common aspects of imagery with the tasks.

6. It was confirmed that there are individual differences in subjective imagery ability also in children, even in 3rd grade. This introduces a new subject for inquiry concerning the origin of imagery differences.

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