Learning Styles:

An Attempt at a Quantitative Assessment

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Introduction

Most research in second language (SL) learning styles has focused on cognitive and affective factors. Willing (1988), Wallace and Oxford (1992) and Oxford et al. (1992) consider four main aspects: cognitive, affective, physiological, and behavioral. Specific behaviors that reflect general learning styles are called *learning strategies* (Oxford *et al.*, 1992:440). Based on these factors a large body of literature has addressed the areas of individual learner differences. Consequently, the term Learning style is not easily distinguishable from cognitive and affective factors. Concerning this Ellis (1994:508) states, *at the moment there are few conclusions that can be drawn from the research on learning style.* He concludes, *it is unlikely that much progress will be made until researchers know what it is they want to measure.*

The Reid Questionnaire

An interesting example of an attempt to categorize and measure learning styles is a study by Reid (1987). Rather than looking at the interaction of cognitive styles and affective variables with situational demands Reid adopted a different perspective. Reid's study, on the basis of research with U.S. schoolchildren by Dunn (1983, 1984) and Reinert (1976), concluded that learners have four basic perceptual learning channels (or modalities):

1. Visual learning: reading, studying charts
2. Auditory learning: listening to lectures, audio tapes
3. Kinesthetic learning: experiential learning, that is, total physical involvement with a learning situation
4. Tactile learning: "hands-on", such as building models or doing laboratory experiments

Reid renamed the four perceptual modalities (visual, auditory, kinesthetic, and tactile) and the two learning styles (group and individual), as the six major learning styles preferences. She designed The Perceptual Learning Style Preference Questionnaire: a questionnaire of thirty questions (Appendix 1). Reid piloted the questionnaire in 1983. Internal-consistency reliability was done by the split-half method. From an original set of sixty questions (10 per learning style), the five with the highest internal correlation for each learning style were selected.

Unfortunately no figures were given. Reid terms this method "validation". It is not clear in what way Reid is distinguishing between reliability and validity. Guilford and Fruchter state, *maximal reliability requires high intercorrelations between items* (1973:434).

Reid's questionnaire was administered to 1234 English as a Second Language (ESL) students in the US, including Japanese and Chinese. 154 native speakers also completed the questionnaire. In ESL at least another fourteen studies have made use of Reid's Learning Style Survey (Reid 1994 fax).

Table 1 shows the results from four of these studies:

Reid: 1987 ESL students: Japanese (J) n = 30, Chinese (Ch) n = 90

Hyland: 1993/1994 ESL and English as a Foreign Language (EFL): Japanese (J): EFL n = 265, ESL n = 140. The groups were reported together.

Hayashi: 1990 Japanese four groups: EFL high school students n = 82, ESL n = 51, students in academic courses in the US n = 60, native speakers (NS) n = 55,

Melton: 1990 Chinese EFL (Ch) n = 334

Table 1 Learning Style Means

	N size	Visual	Auditory	Kinesthetic	Tactile	Group	Individual
Reid Japanese ESL	30	12.52	12.67	13.29	13.32	10.35	12.05
Hyland Japanese EFL/ESL	440	10.93	12.33	12.00	12.18	10.06	11.62
Hayahsi EFL	82 (M,41)	9.77	11.68	10.93	12.27	10.23	12.23
Hayashi ESL	51 (M30)	12.77	13.45	12.80	12.28	10.76	11.37
Hayashi Academic Courses	60 (M19)	12.43	13.52	12.42	13.25	9.23	13.13
Hayashi Native Speakers	55	11.56	12.67	12.66	12.09	10.09	12.27
Reid Native Speakers	154	12.12	13.82	13.64	12.69	10.08	13.13
Reid Chinese ESL	90	13.55	14.09	14.62	14.52	11.15	12.41
Melton Chinese EFL	331 (M134)	12.16	12.63	13.80	14.33	10.49	13.75

Note: Means of 13.50 and above = major learning style preference; means of 11.50−13.49 = minor learning style preference; means of 11.49 or less = negative learning style preference.

A summary of the four studies indicated that:

1. At lower levels students preferred kinesthetic and tactile over visual and auditory styles.
2. Both EFL and ESL students strongly preferred kinesthetic and tactile learning styles.
3. Females had higher kinesthetic and tactile preference scores, although none of the studies offered clear reasons as to why.
4. Among the NNS language groups, the most frequent differences were found among the Japanese speakers. More specifically they showed no preference for any style. At elementary and intermediate levels, Chinese had higher preference styles score for all modalities. However, by graduate level in the target language (TL) environment, Japanese preference means begin

to approach Chinese students' means.

5. The longer the students lived in the TL environment, and the longer they studied either English or in English, the more the preference means for auditory, kinesthetic, and tactile learning increased.

6. The longer the students attended classes taught by native speakers, the higher the preference means were for auditory, kinesthetic, and tactile learning. Visual preference means decreased. Group preference means continued to remain negative. Individual preference means for Chinese and Japanese students stayed, respectively, around the upper and lower limits of the minor learning style preference.

7. Almost all groups showed a negative preference for group learning.

Specific comments concerning the studies

Melton 1990

As all the respondents were EFL students, the auditory mean score was noticeably lower. However it is interesting to note that the Chinese appear to have multiple major learning styles even prior to exposure to multiple cultures. Melton poses the question *Could this be a factor in the high academic achievement and educational success by Chinese who study abroad?* (1990:36).

Hayashi 1990

Hayashi found that high school students in Japan preferred the tactile learning style. The consistent preference for the tactile learning style led her to suggest a third hypothesis: a 'group style' for Japanese. This conclusion is maybe more driven by belief than derived from the data, because the individual learning styles means are higher than the group learning styles means for all of her four groups.

The Preference Styles of Japanese Students

From the Reid questionnaire the findings particular to the Japanese were that:

i) students had no preferred learning styles (Reid, Hyland, and Hayashi) except for Hayashi's students in academic courses group (auditory mean 13.52).

ii) Hyland and Hayashi's EFL high school groups had negative preference means for visual learning style (10.93 and 9.77) respectively.

Concerning i) Reid stated that the purpose of her questionnaire was to provide insights for the classroom and for future research (91). However, her pilot project (1983) for her 1987 study had already produced similar results, as did the replication by Hyland. She made no adjustments to her theoretical framework. In her discussion she attributes this failure to identify a learning style to "reasons yet unknown (although culture may certainly play a part)" (1987:98). It seems likely that as the questionnaire was designed for, piloted, and used in the US educational system, in its present form it may have a cultural bias towards the US environment. Therefore, a possible lack of cross-cultural validity may render it an inappropriate

instrument within the Japanese context. Two explanations are proposed:

A) Ineffectiveness of the Likert Scale

In correspondence with Reid, she felt that the major cause was Japanese students' reticence to express a clear opinion. Therefore on the Likert scale of 1 to 5, the options of 'strongly disagree' and 'strongly agree', or the Japanese equivalents of '*soo omowanai*' or '*soo omou*', would be avoided. However, results rule out this interpretation as the 'strongly agree' extreme is avoided but the 'strongly disagree' extreme is not. Specifically the means are not bunched in the middle at 12.5, but generally are closer to the 'strongly disagree' position (less than 11.5).

B) Little exposure to a varying methodologies and exposure to quasi 'communicative activities'.

The Japanese education system has until very recently permitted little, if any, kind of exposure to alternative learning styles outside the traditional lecture-based presentation of materials, and individual reading assignments. During secondary school (ages 12-18), when students are taught English, there has been little deviation from this standard form, and very few students have experienced classroom methodologies which encourage kinesthetic or tactile learning. First year junior high school students who have been taught new English vocabulary through Total Physical Response (TPR), for example, are in a very small minority. This being the case, it is unreasonable to expect students to be able to indicate a preference for an alternative learning style which is clearly outside the range of their experience. The unsuitability of many of the materials and/or weaknesses in classroom management leave many students with feelings of boredom or embarrassment, rather than stimulation and enjoyment. The outcome regarding some of the activities mentioned on the Reid questionnaire is that often students have:

either 1. no experience of the activities,

or 2. negative experiences.

This tends to confirm Hyland's opinion (1994:65) that where learners have overseas or NS teacher experience their auditory, kinesthetic and group learning preferences can be modified and extended.

The above also indicates that at university, where classes and courses are not directed at the entrance exams, higher preference means may also occur.

ii) EFL high school groups' negative preference means for visual learning style

This may be a reaction against having to read and translate ever increasingly difficult passages: a methodology which predominates at this stage of the Japanese education system.

Japanese Dislike for Group Learning

One major question Reid, Hayashi, and Hyland do not address is why Japanese consistently dislike group learning. Their preference for individual learning appears to be contrary to the framework of Japanese society: a field-dependent culture as defined by Samovar and Porter

(1991:251) and Damen (1987:301). One possible explanation for this apparent paradox is that the classroom methodology traditionally employed affords no opportunity for 'high-context' interaction (Samovar and Porter 1991:235). Especially in junior and senior high schools, the kind of study behavior which is encouraged is discrete and highly analytical: in short it is highly individualistic and therefore displays field-independent characteristics. This is also believed to be the best way to learn.

A Need for Reanalysis

The Learning Style Preference Questionnaire seems to have established a firm foothold within SLA. It has been replicated in both North America and Asia. Several replications were for MA dissertations. Reid herself has complied a number of these studies in *Using Learning Styles in the ESL/EFL* Classroom. A second book is also under consideration. However, perhaps there is a need to reexamine the components and constructs of the questionnaire: in short, its validity and reliability. In particular the following areas were felt to require further examination:

i) The research of Reinert (1976) and Dunn (1979), which influenced Reid's work (1987:89).
ii) The visual modality
iii) The kinesthetic and tactile modalities
iv) The categories of individual and group learning styles
v) The Adequacy of Statistical Procedures

Reinert 1976

Reinert's study was a result of the individualized foreign language program developed in 1969 in the Edmonds (Washington) School District. The aim was to aid the teaching of foreign languages. The Edmonds Learning Style Identification Exercise (ELSIE), which could be administered, scored, and roughly evaluated in thirty minutes of class time, was based on two hypotheses. First, an individual's learning style, used analogously to what is commonly meant by "aptitude" or "talent", is the way in which that person is programmed to learn most effectively. Second, one's pattern of internalization of his native language gives a profile of his learning style (1969:161). In pilot studies students were asked to write out their instantaneous response to each item on a list of randomly selected words. However, it must be remembered that introspection is a skill that not all individuals develop to equal level (Mandler 1984). Reinert's analysis of students' responses identified four major categories.

1. Having a mental image of an object or activity, (termed *visualization*)
2. Having a mental image of the word spelled out, (termed *spelling*)
3. Receiving meaning from the sound of the word without any visualization, (termed *sound*)
4. Having a fleeting kinesthetic reaction, either emotional or physical (termed *feeling*)

Comparing the categories of the Learning Styles Questionnaire with the work of Reinert, category 2 *spelling* presumably equates with Reid's visual learning style. One must conclude that, either category 1. *visualization* is equivalent to Reid's tactile learning style, or the Reid and Reinert categories do not really fit. Students were asked to categorize their immediate

reaction according to the four above categories. Unfortunately, Reinert provided no statistics for his findings. However, analysis yielded three interesting observations:

i) When ELSIE was readministered, each student's overall profile remained consistent, although responses to individual items varied. Identical response rate to individual items of more than 65−70%, or of less than 30−35%, was unusual.

ii) Several participants found that they could not force a predetermined response.

iii) Females indicated a kinesthetic response for more than 25% of the words, compared with a male response of only 17.5%.

Dunn and Dunn 1979, 1983.

Dunn, R. and Dunn, K., after six years of testing and revising instruments, produced *The Learning Style* Inventory (LSI) (Dunn, Dunn, and Price, 1975), a self-reporting questionnaire (see Appendix 2) which enabled public (state) school students to identify their learning style preferences (see Figures 1 and 2). Much of their research was driven by the desire to help young children who were having learning difficulties, particularly with reading. "The LSI is reliable and valid only for grades 3-12" (Dunn and Dunn, 1979:240). For adults Dunn, Dunn and Price produced a different questionnaire in 1981: the Productivity Environmental Preference Survey (see Appendix 3).

The goal of the original research was to match learning and teaching styles. The Learning Style Inventory (LSI) appears to have had considerable influence in mainstream US education. The questionnaire's purpose was:

i) to provide teachers with a framework of analysis of the classroom environment

ii) to provide clearer analysis of both exceptional, and mentally challenged, students.

It has also been employed in doctoral research at more than 70 institutions of higher education in the United States and abroad (Perrin 1991:4). Despite the research based on the LSI, two informed sources stated that the questionnaire is not often administered within the US education system. However, while in college, most future primary school teachers are informed of these modalities, especially those wishing to work in special education. The same two sources independently stated, that "it would be very difficult to take credits in the education area and not encounter this area. Many universities actually have a course devoted wholly to this area." When class size permits, teachers try to accommodate learner's preferences for the visual, auditory, kinesthetic, and tactile modalities.

The Visual Modality

The key question concerns the definition of the 'visual' modality. *The Learning Style Inventory* (LSI) and the Reid questionnaires limit their definition to reading. Reading is problematic, irrespective of whether learners approach the reading of words holistically or analytically, or in a combination of the two. Reading, for both L1 and L2 learners of English, appears as a kind of code, in which the letters themselves can be confusing, and in which, unlike the Japanese 'hiragana' and 'katakana', the script/sound relationship is not always

consistent. As such all teachers and researchers need to be aware of potential reading problems and possible solutions. However, others regard 'visual' as encompassing both reading and viewing (Messick 1976). Barbe and Swassing (1979) developed the Modality Model sometimes described as the VAK Model (visual, auditory, kinesthetic). They recognize that learners not only desire to see things written down but that they also value and enjoy pictures, diagrams, charts etc. Despite having no questions which address the non-reading part of the 'visual' perceptual learning style, Dunn and Dunn, themselves, make a separation: *a visual learner can remember approximately 75% of what he or she has read or seen during a 40- to 50- minute session* (1983:499). What is meant by remember is not clear. Dunn and Dunn continue: *the older the child, the more likely he or she is to recall precisely what has been seen or read.* The adult Productivity Environmental Preference Survey (PEPS) includes questions which address this broader definition of 'visual'. The questionaire statements are: (36) I really enjoy television, (41) The things I remember best are those I have seen in a book or magazine, (51) I really enjoy movies, (80) If I have to learn something new, I like to learn about it by seeing a movie. Although the LSI and PEPS differ in their operational definition of visual, it seems that conceptually Dunn and Dunn accept the wider definition. An example of evidence for this can be seen in the work of the Perrin LSI Primary Version. This was first produced in 1983, and reproduced and modified in 1991. This manual for teachers and administrators clearly states that it is based on the work of Dunn and Dunn. Furthermore Perrin produced in 1993, together with Dunn and Dunn, a manual for young children's individual learning styles. Perhaps the LSI questionnaire, and therefore the Reid questionnaire, might benefit if they:

i) include some questions which address the wider definition of 'visual' and

ii) possibly consider creating two categories: one for reading and a second for the other 'visual' elements.

The Kinesthetic and Tactile Modalities

The key question is how the kinesthetic and tactile modalities differ. Messick suggests that perceptual preferences evolve for most students from kinesthetic (doing), to visual (reading and viewing) and aural (hearing and speaking), as the learner matures and that a dominant preference develops from infancy almost subconsciously (1976:21). Psychologists and educationalists recognise that the distinction between kinesthetic and tactile becomes blurred as the children become older. As such they usually consider the two as one category. Dunn and Dunn, while recognizing that *most kindergarteners are essentially tactile and kinesthetic in style* (1983:489), in the same 1983 paper, discuss tactile/kinesthetic as one of three perceptual strengths, the others being auditory and visual. Therefore, if for older learners the tactile and kinesthetic merge, it is not clear why the LSI questionnaires for grades 3-4 and 5-12 are exactly the same. This possible false distinction would be better merged into one category as in the Hinkleman and Pysock study (1992). Therefore, it may be better if the Reid Questionnaire similarly merged the kinesthetic and tactile categories.

The Introduction of the Categories of Individual and Group Learning Styles

From Reid's article it is not clear as to why she added the categories of individual and group learning styles to the four perceptual learning modalities: visual, auditory, kinesthetic, and tactile. However, from figure 1 it appears to be an eclectic decision based on a simplification of the 6 elements of the sociological stimuli identified by Dunn and Dunn (1979:241, 1983:497). In 1979 Dunn and Dunn classified four levels: environmental, emotional, sociological, and physical. To these, the fifth level 'psychological' was added in 1983. It does not appear that Dunn and Dunn intended to mix any of these five levels, but merely to provide teachers and administrators with a framework for analysis. However, for Reid not to explain that there are five levels, and furthermore to mix two of the five levels without stating why, leaves researchers unclear concerning her theoretical framework. The group style and individual style are from the sociological level and relate more closely to personality, and classroom methodology and experience. Reid may have produced a better study having from the physical level the four perceptual modalities as the dependent variables, since these are the primary modalities of information transmission. The group style and individual style would be the independent variables. The group style and individual style each could have been separated into two groups: those who had preferred style, and those who did not.

Statistical Procedures

Some of the statistical procedures used by Reid in the analysis of the data were inappropriate or incomplete.

i) The Likert Scale of 1 to 5 was changed to a scale of 0 to 4 by her statistics adviser. She did not report this in her paper or was not aware of it. Researchers seeking to replicate the design (such as Hyland) have been confused by preference means being considerably higher than those of Reid's study.

ii) Reid did not explain why 13.5 or above classifies as a major learning style preference, and 11.5 or below as a negative learning style preference.

iii) Correlations were not conducted on each of the sub-groups (e.g. graduates) to see how the six learning styles were related. Therefore, it was not possible to gauge where students favored different learning styles at the same time, or viewed them in opposition.

iv) Repeated measures analysis of variance (ANOVA) were not used. ANOVAs were run on the six learning styles preference means (not stated but clearly the dependent variables) with sub-sections (the independent variables) of: age, language background, TOEFL scores, length of stay in the US, time spent studying in the US, undergraduate or undergraduate level, major field, and gender. As the same data was used, the analysis is in fact a series of repeated two-way ANOVA tests. Therefore in the case of 5 tests the p value should have been set at $p < .01$, not $p < .05$. At this level the undergraduate/graduate distinction for visual, tactile, and auditory styles ($p = .0000, .0000, .0076$ respectively) would have remained significant. However, the male/female distinction for visual/auditory ($p = .042, .0175$ respectively) would have been insignificant. Reid did not report the p values of other findings she claims are significant.

v) No factor analysis was conducted, therefore we do not know to what extent the questions

for the six subsections of the questionnaire have construct validity. Guilford and Fruchter state that for many individuals (presumably researchers) *factorial validity is the most satisfactory form of construct validity* (1973:426). This claim is still maintained by statisticians. Thus, factor analysis is now being more frequently encountered in areas which would have been previously considered the domain of qualitative analysis alone. Factor analysis seeks to identify the underlying clustering. Thus the questionnaires' six subsections should cluster into six separate factors.

vi) Item analysis of the 5 questions for each of the six learning style subsections was not conducted. Although Reid states, *validation of the questionnaire was done by the split-half method* (1987:92), item analysis would have confirmed the degree of internal reliability of each section of the questionnaire, and of each question within each section.

Unfortunately Hayashi, Melton, and Hyland replicated Reid's study without the above variations in statistical procedures. There is a need to apply these procedures in order to more accurately assess the validity and reliability of the Reid questionnaire.

RESEARCH QUESTIONS

1A) Do the visual learning style questions have construct validity?

1B) Are the kinesthetic and tactile learning style questions better as separate or merged constructs?

2) Should certain questions be removed or modified?

3) What kind of variation do differing groups of Japanese students display and how do the results compare with those of previous studies?

METHOD

Subjects

1) Four groups were selected. All student groups were female, two from a private university, and two from a private secondary school. All classes met once a week.

A university first-year cultural studies class: students majoring in English literature (n=83)

A university first-year standard spoken English class; students majoring in English literature (n=45)

Three 'returnee' (students who had lived abroad) second year junior high school classes (n=23, 25, 23).

A standard first-year senior high school spoken English class (n=38).

Procedures

The translated Japanese version of the Reid Questionnaire was given by myself to the two university classes, and by a colleague to the returnee classes and to the high school class. Prior to answering the questionnaire, the students were asked to read the translated version of its purpose, and also asked to answer the additional questions seeking more background

information (see Appendix 4)

Analysis

With the exception of the 'returnee' group, students who had been abroad for a period of longer than two months were removed in order to ensure that only EFL data was analysed, as opposed to ESL data. The following analyses were conducted on the four students groups:

A) To investigate the issues of validity and reliability-research questions 1 and 2

i) For each of the four student groups, the correlations between the six learning style preference means were calculated. The correlations were also calculated for the four groups together. The purpose was to determine the degree of independence of the constructs: that they had no shared variance.

ii) A factor analysis with varimax rotation was conducted on the 30 question items to determine the extent to which the underlying factors as identified by the factor analysis fitted with the six learning style constructs. It was considered statistically appropriate to proceed with this analysis as $n = 237$ was higher than the required $n > 2^m + 2m$ when in this case $m = 6$ (the number of dependent variables).

iii) Item analysis was conducted on the 30 questions to determine the internal reliability of each of the 6 learning style sections, and of each of the 5 questions within each section.

B) To answer research question 3

i) The six learning style preference means were determined and compared with the findings of Reid, Hayahsi, Hyland, and Melton.

ii) A multivariate analysis of variance (MANOVA) was conducted with the learning styles as the six dependent variables and the four student groups as the independent variables.

RESULTS

Preference means

The six learning style means of previous studies and the four groups of the present study are reported in Table 2. Present study results are in bold type.

Table 2 Learning Style Means

	N size	Visual	Auditory	Kinesthetic	Tactile	Group	Individual
Cultural Studies	83	10.2	11.5	9.4	10.0	9.1	10.9
Spoken English	45	10.6	11.9	9.7	10.7	9.9	11.0
Returnees JHS	71	10.0	10.7	11.2	11.1	11.7	9.8
Senior HS	38	9.3	12.2	10.1	12.2	10.5	9.9
Reid Japanese	130	12.52	12.67	13.29	13.32	10.35	12.05
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Hayashi Senior HS EFL	82(M,41)	9.77	11.68	10.93	12.27	10.23	12.23
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Reid NS	154	12.12	13.82	13.64	12.69	10.08	13.13
Reid Chinese	90	13.55	14.09	14.62	14.52	11.15	12.41
Melton Chinese	331(M134)	12.16	12.63	13.80	14.33	10.49	13.75

Comparing the four groups with the results from previous studies the following points should be noted:

i) the mean scores, including those of the returnees, were lower than almost all other studies.

ii) the senior high school students, means were very similar to those of Hayashi (H HS), apart from individual learning style means (9.9 v 12.23).

iii) Reid defined a negative learning style as having a mean of 11.5 or less. As such only 5 of the 24 means were not negative learning style preferences.

iv) only the returnees had a negative preference for auditory learning style (10.7).

v) the junior high school returnee students' kinesthetic mean was considerably higher than the means of the other three groups.

vi) the senior high school tactile mean was considerably higher than the means of the other three groups.

vii) the returnees' group learning style mean (11.7) was higher than all other groups, including the Chinese groups.

In order to determine whether any significant differences were present between the four groups, a MANOVA analysed the six learning styles (dependent variables) against the groups (independent variables). The Hotellings test indicated significance was present (Table 3):

Table 3 n =237.

Multivariate Tests of Significance (S = 3, M = 1 , N = 113)

Test Name	Value	Approx.	F Hypoth. DF	Error DF	Sig. of F
Hotellings	.24626	3.10099	18.00	680.00	.000

Univariate F tests (Table 4) indicated the significant learning styles to be auditory, kinesthetic, and group (p = .004, .001, and .000 respectively).

Table 4 Multivariate analysis of six learning styles for all groups

Variable	Hypoth. SS	Error SS	Hypoth. MS	Error MS	F	Sig. of F
Visual	31.60505	1252.17554	10.53502	5.37414	1.96032	.121
A	70.08850	1170.01277	23.36283	5.02151	4.65255	**.004**
K	142.88554	2082.25370	47.62851	8.93671	5.32953	**.001**
T	43.97333	1783.25030	14.65778	7.65343	1.91519	.128
G	258.41598	3061.38992	86.13866	13.13901	6.55595	**.000**
I	70.14105	2472.44966	23.38035	10.61137	2.20333	.088

Further analysis using the Scheffé test showed that there were significant differences between:

High school students and others for: auditory $p = .0035$
Returnee students and others for: kinesthetic $p = .0013$
Returnee students and others for: group $p = .0003$

Correlations

Table 5 shows the correlations of the six learning style preference means (the dependent variables) for each of the four student groups and also for the four groups together.

Table 5 Correlations for the four groups for each of the six preferred learning styles

V = Visual, A = Auditory, K = Kinesthetic, T = Tactile, G = Group, I = Individual
N of cases: 237 1-tailed Signif: * - .01 ** - .001

Cultural Studies

Correlations:	V	A	K	T	G	I
V	1.0000	.0624	.0462	.0599	-.0797	.3303*
A	.0624	1.0000	.3706**	.3788**	.2358	-.0056
K	.0462	.3706**	1.0000	**.7414****	**.5052****	-.2859*
T	.0599	.3788**	**.7414****	1.0000	.3666**	-.1731
G	-.0797	.2358	**.5052****	.3666**	1.0000	-.4673**
I	.3303*	-.0056	-.2859*	-.1731	**-.4673****	1.0000

Spoken English

Correlations:	V	A	K	T	G	I
V	1.0000	-.2573	-.1572	-.2033	-.0583	.0455
A	-.2573	1.0000	.0931	.0831	.1226	-.1190
K	-.1572	.0931	1.0000	.7461**	.6801**	-.4400*
T	-.2033	.0831	**.7461****	1.0000	.5572**	-.3935*
G	-.0583	.1226	**.6801****	.5572**	1.0000	-.5822**
I	.0455	-.1190	-.4400*	-.3935*	**-.5822****	1.0000

Junior High School Returnees

Correlations:	V	A	K	T	G	I
V	1.0000	-.0198	.1256	.1505	-.0382	.5922**
A	-.0198	1.0000	.5302**	.3435*	.2070	-.1458
K	.1256	**.5302****	1.0000	.4612**	.3922**	-.0227
T	.1505	.3435*	**.4612****	1.0000	.1922	.0035
G	-.0382	.2070	.3922**	.1922	1.0000	-.2456
I	**.5922****	-.1458	-.0227	.0035	-.2456	1.0000

Regular High School

Correlations:	V	A	K	T	G	I
V	1.0000	.0359	.0472	.0081	-.0422	.0938
A	.0359	1.0000	.1649	.1274	-.2037	.0869
K	.0472	.1649	1.0000	.3246	.5040**	-.5859**
T	.0081	.1274	.3246	1.0000	.0994	-.2188
G	-.0422	-.2037	.5040**	.0994	1.0000	-.7030**
I	.0938	.0869	**-.5859****	-.2188	**-.7030****	1.0000

All Groups

Correlations:	V	A	K	T	G	I
V	1.0000	-.0224	.0121	.0250	-.0679	.3030**
A	-.0224	1.0000	.2655**	.2464**	.1035	-.0240
K	.0121	.2655**	1.0000	.6488**	.5408**	-.3121**
T	.0250	.2464**	**.6488****	1.0000	.3489**	-.1815*
G	-.0679	.1035	**.5408****	.3489**	1.0000	-.4712**
I	.3030**	-.0240	-.3121**	-.1815*	**-.4712****	1.0000

For all the groups together squaring the correlations of the following learning styles indicates that:

for kinesthetic and tactile learning styles 40% of the variance was shared.

for kinesthetic and group learning styles 30% of the variance was shared.

for group and individual learning styles 20% of the variance was shared.

For the four student groups the following correlations were significant at $p < .001$, establishing the presence of interaction between these six dependent variables:

i) Tactile and kinesthetic learning styles correlated for all groups, except the high school group.

ii) Kinesthetic and group learning styles correlated for all four groups.

iii) Group and individual styles correlated negatively for all student groups, except the returnees.

iv) Visual style correlated significantly only once: for the returnee group, with individual style.

v) Auditory and kinesthetic styles correlated for both the returnee and cultural studies groups.

vi) Tactile and group styles correlated for both university classes, but not for the returnee or regular high school groups.

Factor Analysis of the 30 Questions

Varimax rotation indicated eight underlying clusterings (factors) were present (Table 6). The percentage of variance in student responses accounted for by the first four factors was 45%. Factor 1 accounted for 21.6% of this variance.

Table 6 Factor Analysis by Varimax Rotation

Extraction 1 for Analysis 1, Principal-Components Analysis (PC)

Variable	Communality	* Factor	Eigenvalue	Pct of Var	Cum Pct
A	1.00000 *	1	6.47875	21.6	21.6
B	1.00000 *	2	2.95997	9.9	31.5
C	1.00000 *	3	2.30111	7.7	39.1
D	1.00000 *	4	1.75704	5.9	45.0
E	1.00000 *	5	1.54726	5.2	50.1
F	1.00000 *	6	1.41883	4.7	54.9
G	1.00000 *	7	1.14016	3.8	58.7
H	1.00000 *	8	1.10295	3.7	62.4

The loadings of each question onto Factors 1 to 5 are shown in Table 7. Figures marked in bold indicate the question has a significant loading (0.3 or more).

Table 7 Rotated Factor Matrix for the 30 questions: ordered by learning style subsections

Questions 6 to 29 visual, 1 to 20 auditory, 2 to 26 kinesthetic, 11 to 25 tactile, 3 to 23 group, 13 to 30 individual

	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5	FACTOR 6	FACTOR 7	FACTOR 8
6	.00063	-.01596	.01757	-.05936	.14397	**.62**	.28	.28
10	.16102	-.11126	.08556	.05831	**.72835**	.08	.04	.17
12	-.12358	.11767	.24846	**.37012**	.19168	.26	.04	.18
24	-.07450	-.08983	.11069	**.48557**	**.48670**	-.12	-.17	-.18
29	.00844	.07146	**.46447**	-.03611	**.42745**	**-.53**	.01	.19
1	-.01110	-.02089	.09654	-.01650	-.09466	.09	.78	.00
7	.08272	.11536	-.10806	.08513	-.00182	.16	.01	**.82**
9	.14152	-.05304	.04175	.15169	**-.78061**	.04	.06	.11
17	.10792	-.17422	.13322	-.02699	-.05673	**.75**	-.03	.06
20	**.38784**	.29418	.01685	.03125	.04019	.03	-.08	.51
2	.28338	**.32691**	-.19079	**.61364**	-.08234	-.15	.07	.14
8	.23517	.23921	-.07035	**.76451**	-.08848	.04	.00	.14
15	**.72647**	.15863	-.09007	.05009	.03069	.20	-.16	.02
19	**.61614**	.11407	-.20257	.12866	.01570	-.18	.19	.21
26	**.62540**	.14521	.00189	**.35185**	-.07256	.02	-.11	-.07
11	**.50490**	-.19301	-.18464	.25727	-.05282	-.09	.31	.22
14	**.57825**	**.36900**	-.04046	.11546	.14488	.04	-.19	.06
16	**.66482**	-.15495	-.11486	-.10355	-.00468	-.04	.05	.13
22	**.62220**	.15328	.10538	-.08309	-.19814	.23	.15	-.05
25	**.58356**	.20031	.05225	.24696	.03357	-.06	**-.36**	.06
3	-.03398	**.81245**	-.10511	.18023	-.14029	-.12	.00	.07
4	.09035	**.83521**	-.26266	.12296	-.00608	-.01	-.10	.06
5	.15520	**.79352**	-.14890	.10396	-.03166	-.13	-.11	.12
21	**.49193**	**.55935**	-.17173	.04788	.13230	.05	.09	.12
23	**.35844**	**.54585**	-.29036	-.01093	.02561	-.01	.24	-.02
13	-.06256	-.18864	**.61761**	.01341	.07580	.01	.28	-.01
18	-.01886	-.09493	**.67118**	.19533	.15472	-.01	**.38**	-.26
27	-.13060	-.17405	**.70517**	.02374	.07753	.17	.05	-.21
28	-.00744	-.16635	**.78592**	-.09870	-.10335	.03	-.17	.19
30	-.10547	-.15532	**.71472**	-.13423	-.01656	-.09	-.08	-.04

By looking across the factors columns it is possible to analyze the six learning style subsections. This indicates how well the 8 factors fit Reid's subsections. Three facts are clear

i) the questions addressing visual and auditory styles are a very poor fit, being spread across several factors: visual - factors 3 through 7, and auditory - factors 1, 5, 7, and 8.

ii) the questions addressing group and individual styles fit very cleanly.

iii) the questions addressing the tactile style fit quite well with some of the kinesthetic questions.

Specifically for each factor the loadings show the following:

i) factor 1: all the tactile questions loaded together. However, three of the kinesthetic

questions (15, 19, and 26) also loaded with the 5 tactile questions.

ii) factor 2: all the group questions loaded together. Question 2 kinesthetic and question 14 tactile also loaded. However, both these questions had heavier loadings on other factors.

iii) factor 3: all the individual style questions loaded together. Visual style question 29 also loaded and it was the questions' heaviest loading.

iv) factor 4: three kinesthetic style questions (2, 8, and, as a minor loading, 26) loaded together with visual style questions 12 and 24.

v) factor 5: visual style questions 10, 24, and 29 loaded together. However, questions 24 and 29 also loaded equally on factors 3 and 4 respectively.

vi) factors 6, 7, and 8: these were the least significant, generally having a loading of less than 0.3 per question. However, Factor 6 auditory style question 17 loaded with visual style 6, but negatively with visual style question 29. Factor 7: auditory style question 1 loaded by itself. Factor 8: auditory style questions 7 and 20 loaded together.

Item Analysis

The internal reliability of the questions for each learning style subsection analysed by item analysis are reported in Table 8:

Table 8 Internal Reliability of Questions for the 6 Learning Style Subsections

	Cultural Studies	Spoken Eng.	Returnees	High School	All Groups
Visual	.534	.334	.096	.618	.358
Auditory	.444	.195	.312	.132	.352
Kinesthetic	.820	.752	.514	.481	.748
Tactile	.736	.669	.564	.429	.668
Group	.894	.808	.758	.711	.801
Individual	.874	.748	.680	.846	.751

Important results were:

i) the high reliability of the questions addressing group and individual learning styles.

ii) the variation in reliability between the 2 university groups and the 2 school groups. However, this variation was confined to questions addressing visual and auditory learning styles.

iii) the poor reliability of the questions addressing visual or auditory styles. Item analysis also provided specific data (Table 9) for the internal reliability of each learning style section if each question is deleted, leaving only the other four questions.

Table 9 Internal Reliability by item analysis of each section if one question is deleted

Questions		Cultural Studies	Spoken Eng.	Returnees	High School	ALL GROUPS
Visual	6	.584	.387	.389	.623	.465
	10	.334	.240	-.212	.536	.141
	12	.404	.345	.006	.580	.249
	24	.445	.209	-.102	.464	.230
	29	.533	.242	-.156	.558	.286
Auditory	1	.468	.249	.282	-.080	.352
	7	.313	.126	.242	..091	.256
	9	.347	.144	.346	.147	.306
	17	.448	.221	.147	-.028	.294
	20	.380	.156	.199	.433	.288
Kinesthetic	2	.764	.657	.462	.387	.674
	8	.763	.727	.450	.599	.693
	15	.793	.758	.464	.420	.729
	19	.772	.667	.502	.367	.708
	26	.787	.683	.349	.451	.680
Tactile	11	.684	.672	.450	.145	.631
	14	.636	.562	.578	.259	.588
	16	.718	.636	.524	.462	.636
	22	.736	.586	.496	.350	.634
	25	.670	.636	.422	.505	.590
Group	3	.866	.796	.689	.696	.758
	4	.838	.758	.645	.587	.735
	5	.852	.733	.713	.647	..756
	21	.895	.792	.764	.730	.805
	23	.893	.766	.777	.579	.803
Individual	13	.867	.705	.596	.859	.711
	18	.837	.713	.620	.770	.705
	27	.847	.673	.574	.864	.705
	28	.843	.713	.620	.792	.710
	30	.833	.698	.685	.775	.702

The analysis of individual questions indicates the following:

i) for the visual and auditory subsections, in order to increase the reliability by removing questions (visual Q6, auditory Q1), the reliability would still be low (less than .5).

ii) the questions addressing the individual learning style are the best. Removal of any of the questions would lower the individual learning style reliability of .751 (Table 8) to about .710 (Table 9)

iii) although the group learning style reliability was high with all samples, if questions 21 and 23 had been removed, reliability would have been raised to .805 and .803 respectively. This is supported by Table 7 in which these two questions load not only onto Factor 2, but also onto Factor 1.

DISCUSSION

Research Questions 1 and 2

1A) Do the visual learning style questions have construct validity?

1B) Are the kinesthetic and tactile learning style questions better as separate or merged constructs?

2) Should certain questions be removed or modified?

Correlations

The correlations indicate that there is more shared variance than one would hope for (kinesthetic/tactile 40%, and group/kinesthetic 30%).

Factor Analysis and Item Analysis

From factor analysis indications are that the constructs of the Reid Questionnaire are likely to be:

i) valid when considering group or independent styles

ii) invalid for the visual learning style. Although factor 5 showed that an analysis based on questions 10, 24, and 29, with the removal of questions 6 and 12, may provide a better construct, item analysis indicates that the reliability of the questions would still be less than 500.

iii) invalid for the auditory learning style. This result was the most surprising. The questions' loading spread across four factors.

iv) fairly valid for kinesthetic and tactile learning styles, if they are considered as one category without questions 2 or 8. Item analysis showed that the reliability of all of the questions was also high. Only for questions 2 and 8 did all 8 teachers consider that the questions were wholly or partially addressing the kinesthetic learning style. In the students' responses (Table 7) questions 2 and 8 loaded onto Factor 5, as opposed to questions 15, 19, and 26 which loaded onto Factor 1. Therefore it may be better to consider two separate constructs, one tactile, and one developed from statements 2 and 8 (I prefer to learn by doing something in class; When I do things in class, I learn better).

Research Question 3)

What kind of variation do differing groups of Japanese students display and how do the results compare with those of previous studies?

Means and MANOVA

1. Although the high school EFL groups' auditory mean is significantly higher than the other three groups in this study, it does not appear to be higher than in previous studies, notably the Hayashi high school group. Perhaps a more appropriate question to consider is why other groups' auditory means are lower, including those of the returnees. It is possible that the answers reflect students' feelings concerning the way in which English classes are conducted in

Japan. Having myself taught such students, I have found them to seem frustrated with teaching which is conducted almost entirely in Japanese and which is too rigid, usually accepting only one answer as correct. This is particularly the case with the returnees. In addition to coping with the normal problems of adolescence, the returnees have to adapt and readjust to school life back in Japan. One area of study, English, which should invoke pleasant memories, all too often proves to be highly unpalatable.

2. Similarly returnees' wider experience at an early age of other cultures and education systems may explain i) why they have a significantly higher preference for kinesthetic styles and ii) why they are the only group (in this study and previous studies) that does not have a negative preference for group learning, and also does not view it as being diametrically opposed to individual learning style.

3. The overall low levels of the means of the four groups may suggest that students have not had enough exposure to a variety of classroom methodologies.

CONCLUSION

For EFL/ESL students the questionnaire would have higher validity if the kinesthetic and tactile subsections were considered as one. Dunn and Dunn and other educationalists and psychologists have made arguments for the acceptance of there being three perceptual modalities (kinesthetic/tactile, visual, and auditory), although the LSI and PEPS have not done this. The main problem with the Reid questionnaire appears to be the construct validity and reliability of the visual and auditory questions. Questions on both of these styles do not appear to be cohesive. If 'visual' is to be viable as a learning style, then a new set of questions needs to be found. Such questions might benefit from a broadening of the definition from that of reading alone.

Another possible problem is that the questions may need to be modified for the Japanese context. The questionnaire, despite having been administered to many nationalities, may lack cross-cultural validity. It must be remembered that the main aim of Dunn and Dunn's work was to identify L1 students within the US education system who had particular weaknesses and strengths. Reid in looking at different nationalities, learning style preferences is possibly using a theoretical framework and associated tools (the adapted LSI questionnaire) for a purpose for which it was not originally intended.

By looking at research in education and psychology Reid has broadened the field of Second Language Acquisition (SLA). Rather than discarding the Reid questionnaire, further studies and experimentation are needed. They should incorporate into their design factor analysis and item analysis to ensure construct validity and reliability. It is ideal that an instrument be validated in a cross-cultural context, or at least establish, for cultural or other reasons, whether a questionnaire is universally reliable or replicable. US mainstream education has considered learning styles, particularly those of perceptual modality, to be important for more than twenty years. It is the responsibility of the field of SLA to provide, not only instruction concerning the existence of learning styles, but also both reliable and administerable tools for measurement.

Furthermore, materials and methodology should seek to accommodate these individual learner differences.

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APPENDIX

Perceptual Learning Style Preference Questionnaire

Name_____ Age_____ Date_____

Native Country_____ Native Language_____

Graduate_____ Undergraduate_____ Male_____ Female_____

How long did you study English in your country?_____

How long have you LIVED IN AN ENGLISH SPEAKING COUNTRY?_____

What is your major field?_____

Most recent TOEFL score?_____ Date of TOEFL_____

Directions: People learn in many different ways. For example, some people learn primarily with their eyes (visual learners) or with their ears (auditory learners); some people prefer to learn by experience and/or by "hands-on" tasks (kinesthetic or tactile learners); some people learn better when they work alone, while others prefer to learn groups.

This questionnaire has been designed to help you identify the way (s) you learn best - the way (s) you prefer to learn.

Read each statement on the following pages. Please respond to the statements AS THEY APPLY TO YOUR STUDY OF ENGLISH. Decide whether you agree or disagree with each statement. For example, if you strongly agree, mark:

strongly agree	agree	undecided	disasgree	strongly disagree
X				

Please respond to each statement quickly, without too much thought. Try not to change your responses after you choose them. Please use a pen to mark your choices.

Questionnaire Statements

1. When the teacher tells me the instructions, I understand better.
2. I prefer to learn by doing something in class.
3. I get more work done when I work with others.
4. I learn more when I study with a group.
5. In class, I learn best when I study with others.
6. I learn better by reading what the teacher writes on the board.
7. When someone tells me how to do something in class I learn it better.
8. When I do things in class, I learn better.
9. I remember things I have heard in class better than things I have read.
10. When I read instructions, I remember them better.
11. I learn more when I can make a model of something.
12. I understand better when I read instructions.
13. When I study alone, I remember things better.
14. I learn more when I make something for a class project.
15. I enjoy learning in class by doing experiments.
16. I learn better when I make drawings as I study.
17. I learn better in class when the teacher gives a lecture.
18. When I work alone, I learn better.
19. I understand things better in class when I participate in role playing.
20. I learn better in class when I listen to someone.
21. I enjoy working on an assignment with two or three classmates.
22. When I build something, I remember what I have learned better.
23. I prefer to study with others.
24. I learn better by reading than by listening to someone.
25. I enjoy making something for a class project.
26. I learn best in class when I can participate in related activities.
27. In class, I learn better when I work alone.
28. I prefer working on projects by myself.
29. I learn more by reading textbooks than by listening to lectures.
30. I prefer to work by myself.