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An exploratory study for factorial validity of cognitive styles among Japanese adult EFL learners: from educational and cultural perspectives

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Abstract

One of the major issues in L2 learning and cognitive styles is the ambiguity of these concepts. A solution to this issue should involve the following two aspects. First, studies of factorial validity should be conducted with empirical data, and with an appropriate analysis using a theoretically well-developed scale. Second, such studies should focus on a particular group of learners, as the learning and cognitive styles could be affected by learners' cultural and educational backgrounds. This study, focusing particularly on cognitive styles, aims (1) to explore whether the concept of cognitive styles represented in the Ehrman and Leaver Learning Style Questionnaire (Ehrman & Leaver, Ehrman and Leaver Learning Style Questionnaire, 2002) show factorial validity for Japanese adult EFL learners and (2) if it does not, to explain the new factor structure, particularly in terms of Japanese educational and cultural backgrounds. Exploratory factor analysis was conducted for the dataset comprising 362 Japanese adult EFL learners, and the frequency distribution of each extracted factor was also investigated. (1) The result did not support the factorial validity as it extracted three factors different from the original questionnaire: impulsive – reflective (access to actual behavior), active – passive (cognitive engagement), and global – particular (cognitive focus); and (2) the new factor structure is discussed in terms of Japanese backgrounds such as cautious behavior, on which a certain value is often placed in Japanese culture, and the influences of university entrance examinations in the Japanese education system. The last part of the paper describes some pedagogical implications for effective use of the questionnaire in practical situations.

Keywords: Learning styles, Cognitive styles, Factorial validity, Exploratory factor analysis, Japanese adult EFL learners, Educational and cultural backgrounds

Introduction and literature review

Current issues in learning styles

With the prevalence of the learner-centered approach, a paradigm shift has emerged, abandoning conventional and uniform methods of education, in various situations. In contrast, the idea that education should meet each learner's needs and preferred ways of learning has played a central role in education for the past few decades. Through investigations of individual differences in both their theoretical and practical aspects,

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the concept of learning styles has developed, which aims to explain "how people learn in different ways and how we all have our own preferred, thus more effective, ways of learning" (Dörnyei & Ryan, 2015, p. 106). Although the fields of psychology and business, as well as education, have paid great attention to learning styles, mainly in Europe and the United States, academic interest has gradually waned over the last 10 years. One of the major reasons for this is the ambiguity of the concept. Learning styles are too intangible to clearly understand, and this theoretical failure has inhibited the development of sophisticated measurement methodologies. In other words, academic studies have long suffered from a lack of evidence on the existence and effects of learning styles. According to the Learning and Skills Research Center in the United Kingdom, more than 70 theoretical models have been suggested (Coffield, Moseley, Hall, & Ecclestone, 2004). Coffield (2005) states that "the field of learning styles suffers from almost fatal flaws of theoretical incoherence and conceptual confusion" (p. 28).

Similarly, L2 studies have also focused on each individual's learning styles since the learner-centered approach emerged. Although the research field had actively employed theoretical findings from other areas and developed several measurement scales on L2 learning by the beginning of the 2000s, it suffered from a lack of attention due to conceptual ambiguity over the past decade. Dörnyei and Ryan (2015) point out that "empirical studies conducted on L2 learning styles have typically produced weak, mixed, or at best moderate results; as a consequence, there has been a gradual loss of interest in language learning style research" (pp. 123–124). However, this does not necessarily mean that the concept of learning styles should be ignored. As Dörnyei (2005) insists, "the current confusion is merely due to our insufficient knowledge rather than the scientific inadequacy of the concept" (p. 120), each individual's needs and preferred ways surely exist as a factor of individual differences in L2 learning. Thus, academic research should not cease efforts to understand the concept and develop appropriate measurement scales. Recently, Griffiths (2012) has also emphasized the importance of learning styles again:

> [Understanding the concept has] the potential to greatly enhance learning and to make learning more enjoyable and successful. It is a concept that acknowledges individual differences, rather than seeing all learners as similar. For teachers, it presents an opportunity to offer students methodologies and materials appropriate to their own learning style preferences. For learners, it allows them the freedom to learn in ways which are enjoyable and can help them to become the best that they are capable of. (p. 151).

Cognitive styles as a part of learning styles

The oft-cited definition of learning styles is that they refer to "an individual's natural, habitual, and preferred way(s) of absorbing, processing, and retaining new information and skills" (Reid, 1995, p. viii). However, as mentioned above, it is not easy to understand the exact meaning of learning styles.

One solution to this difficulty is to divide learning styles into distinctive subcomponents, as they include various aspects (Ehrman, Leaver, & Oxford, 2003; Ehrman & Oxford, 1990). Based on previous studies of L2 learning styles, Leaver, Ehrman, and Shekhtman (2005) suggested three subcomponents: sensory preferences, personality types, and cognitive styles. Further, Dörnyei and Ryan's (2015) comprehensive work on

individual differences dedicates a chapter to "learning styles and cognitive styles," which explains each style as a different concept at its fundamental level of functioning. The present study also follows the same taxonomies and focuses especially on cognitive styles. Cognitive styles describe the styles of cognitive information processing. Armstrong, Peterson, and Rayner (2012) defined cognitive styles as "individual differences in people[']s preferred way of processing information using cognitive brain-based mechanisms and structures" (p. 451). Similarly, Leaver et al. (2005) explain them as "individualized ways of processing of information" (p. 65), and distinguish them from both sensory preferences, defined as "the channels through which we perceive information which consist of visual, auditory, and motor modalities" (p. 65), and personality types, defined as "another kind of learning style [that] involve[s] affective factors" (p. 65).

Previous L2 research on the concept and measurement of cognitive styles yielded major findings and created three unique questionnaire scales: The Style Analysis Survey (SAS; Oxford, 1999), the Learning Style Survey (LSS; Cohen, Oxford, & Chi, 2001), and the Ehrman and Leaver Learning Style Questionnaire (E&L; Ehrman & Leaver, 2002, 2003). While the SAS and the LSS measure the entirety of learning styles, including sensory preferences (visual, auditory, hands-on) and personality types (extraversion, introversion), as well as cognitive styles, the E&L focuses particularly on cognitive styles.

The E&L has two remarkable theoretical features. First, it includes as many as 10 theoretical backgrounds based on previous findings to cover various kinds of cognitive-style concepts (i.e., field independent – field dependent, field sensitive – field insensitive, leveling – sharpening, global – particular, impulsive – reflective, synthetic – analytic, analogue – digital, concrete – abstract, random – sequential, inductive – deductive; Leaver et al., 2005). The second is its overall bipolar concept, synoptic – ectenic, which collates the ten cognitive-style theories based on each style's common principle. According to Leaver et al. (2005), "synoptic learning is reliant on intuition and subconscious control whereas ectenic learning generally occurs under the conscious control of the learner" (p. 70). The synoptic – ectenic view is quite new in that it refers to learners' consciousness at the time of information processing. The Appendix lists the 10 theoretical backgrounds with actual measurement questions included in the "synoptic – ectenic" bipolar scale. Considering these two theoretical validation efforts, the present study discusses cognitive styles based on the concepts and measurement items introduced in the E&L.

Factorial validity and learners' backgrounds in cognitive styles

Distinguishing cognitive styles from learning styles leads to a "purer definition" focusing particularly on information processing in L2 learning (Dörnyei & Ryan, 2015, p. 113). Besides, the E&L is based on the previous powerful theories and its developers have made great efforts to validate it. However, to challenge the conceptual ambiguity, there are still two other important aspects to be considered.

The first issue is factorial validity, represented as consistency between a theoretical background and actual data measured using an appropriate instrument. The research on language learning strategies, an academic specialization that is likely to have a strong relationship with learning and cognitive styles, has devoted great attention to factorial validity. For example, the Strategy Inventory for Language Learning (SILL; Oxford, 1990), one of the most frequently used questionnaires, has undergone a large

number of exploratory and confirmatory factor analyses as part of the ongoing discussion on its taxonomy (e.g., Ardasheva & Tretter, 2013; Heo, Stoffa, & Kush, 2012; Hsiao & Oxford, 2002; Oxford & Burry-Stock, 1995). On the other hand, cognitive styles, particularly with regard to the E&L, have suffered from lack of such empirical evidence.

The second is whether all the question items in the E&L are equally essential to all second or foreign language learners in the same manner. As Kolb, Boyatzis, and Mainemelis (2001) and Nelson (1995) point out, the development of cognitive styles can be affected by early educational and cultural experiences. Therefore, particular learners in a specific area probably develop and maintain their unique cognitive styles. In other words, some theories of cognitive styles could be ignored or some question items could be reassembled into a new group in a particular setting.

In terms of these two issues, Yasuda (2016) conducted exploratory factor analysis for Japanese adult EFL learners focusing on the E&L's five subscales: field-independent – field dependent, leveling – sharpening, global – particular, synthetic – analytic, and inductive – deductive (see Appendix). This resulted in removing six of the fifteen question items and extracting a different factor structure from the original with the remaining nine items. In other words, there is no clear coherence between the E&L's theoretical concept and the data on Japanese adult EFL learners' actual cognitive styles. This mismatch indicates a part of conceptual ambiguity of cognitive styles.

As stated above, L2 cognitive styles should be distinguished from other learning styles to challenge the conceptual ambiguity. Although the developers of the E&L made great effort to explain the concept of cognitive styles in a theoretical manner, the questionnaire still needs to undergo a statistical validation process for a particular group of learners to provide a better understanding of the concept. Thus, the present study aims to adapt the E&L to Japanese adult EFL learners with exploratory factor analysis (EFA). The following part of this section explains the focused domains more deeply.

Japanese adult EFL learners

This study adopts Japanese adult EFL learners as a target group. First, the aspect of *adult* learners is strongly related to the issue of whether cognitive styles are stable or stretchable over time. The previous findings have shown that cognitive styles seem to be partly stable (Richardson, 2011), affected by both genetic factors (Coffield et al., 2004) and early educational experiences (Kolb et al., 2001). On the other hand, many researchers have described the stretchability of cognitive styles (Cohen, 2010; Dörnyei, 2005; Oxford, 2011), which is also supported by several empirical studies (Griffiths & İnceçay, 2016). However, based on some traditional theories, cognitive styles are more stable than other aspects of learning styles (Curry, 1983). Regarding these findings in light of Cohen's (2010) idea of style-stretching (see the citation below), it would appear that each language learner has both stable and stretchable aspects.

> A given reader may have been so global in her approach to reading academic texts that she was missing specific details that could have assisted her in deriving meaning from the texts. With proper encouragement from the teacher, she can become more versed at maintaining her global perspective, whilst paying more attention to particulars as well. (Cohen, 2010, p. 162).

Conclusively, as for the stability and stretchability issue, this study adopts the following four ideas. (1) Parts of cognitive styles are stable, affected by both genetic and early educational experiences. (2) However, some stretchability still remains. (3) The stretchability is gradually lost (i.e., the stability solidifies) as learners become adults. (4) Therefore, each learner has both stable and stretchable aspects of cognitive styles.

Hence, adult learners probably show more stable cognitive styles, while they still have some stretchable aspects. Thus, investigating the cognitive styles of adult learners leads us to a simpler understanding because their styles probably do not fluctuate as often as those of children. In that sense, it provides a very important methodological benefit.

Second, this study also focuses on the aspect of *Japanese EFL* learners. As described above, learning styles, including cognitive styles, have been studied primarily in certain Western countries. The E&L has also been validated through L2 learning processes, mainly those of the US diplomatic staff at the Foreign Service Institute. Because learning styles are affected by different kinds of educational and cultural backgrounds (Kolb et al., 2001; Nelson, 1995), it still remains doubtful whether or not the E&L can be applied to learners in different learning settings. However, since researchers recently have not shown much interest in learning and cognitive styles, there has been little discussion of this issue. Particularly with regard to Japanese EFL learners, academic research seems to have lost interest at a very early stage. In fact, in international and domestic databases for academic papers (e.g., Linguistics and Language Behavior Abstracts, Citation Information by National Institute of Informatics), we have not found an adequate number of articles related to Japanese EFL learners' learning and cognitive styles. This means that, particularly in Japanese EFL settings, the concept of cognitive styles has scarcely been investigated.

Research questions

1. Does the concept of cognitive styles represented in the E&L show factorial validity for Japanese adult EFL learners?
2. If it does not, how can the new factor structure be explained, particularly in terms of the Japanese educational and cultural backgrounds?

Methods

Participants

This study recruited Japanese adult EFL learners with a broad spectrum of proficiency levels. A total of 435 undergraduate students were recruited at several universities in the vicinity of the Greater Tokyo Area. Their native language was Japanese and they had never been abroad for more than three months. Removing 63 cases who made one or more mistakes in their responses to the questionnaire survey (see the instrument and procedure below), the remaining 372 cases were adopted for the subsequent statistical analysis. The average age of the participants was 19.50 years old ($SD = 1.29$). Although there was a gap between genders (female = 105, male = 262, unknown = 5), this represented the fact that there were more male students in Japanese universities than female students.[1] The participants covered a wide range of majors, including education (i.e., educational studies, English language, Japanese language, social studies, science, and mathematics), social science, commerce, and engineering. There were 261

freshmen (70.2%), 47 sophomores (12.6%), 31 juniors (8.3%), 17 seniors (4.6%), 5 more-than-4th-year seniors (1.3%), and 11 grade-unknown students (3.0%).

The participants of this study also covered a wide range of proficiency levels. Based on a placement test conducted at one of the targeted universities, the participants were classified into four proficiency levels: beginner, low-intermediate, high-intermediate, and advanced.[2] The placement test has been developed as a sister product of one of the most widely-used computerized adaptive tests (CATs) in Japan. It consisted of four sections to assess the English knowledge and listening abilities that are frequently used in situations such as daily life, school life, and business settings. Each section evaluated the followings: (1) knowledge of vocabulary, (2) knowledge and use of phrasal expressions, (3) listening ability to understand the main idea, and (4) listening ability to understand specific information. This test brings a more dynamic and accurate measurement based on the item response theory (IRT), which enables selected items to be presented to an examinee according to his or her response to the previous item (test question). Besides, although the placement test did not have any section to measure speaking abilities, it has functioned as a placement test for an English conversation course in the target university. In fact, a set of empirical data showed that the test scores had a positive relation with the ability to produce more complex, accurate, or fluent speech (Suzuki, 2017).

Based on an official conversion table between the score on the placement test and the Test of English for International Communication (TOEIC) Listening & Reading, Table 1 shows the number of participants and the converted range of TOEIC Listening & Reading scores at each proficiency level.[3] Furthermore, another conversion table shows most of the participants classified as A2 or B1 in the Common European Framework of Reference for Languages (CEFR; Colloquium on the English Four Skills Qualification Examination, 2017). As the number of participants was much greater in the low- and high-intermediate levels than in the beginner and advanced levels, the sample distribution with a peak in the middle proficiency levels apparently reflected the actual number of learners in its population.

Instrument and procedure

This study adopted the Ehrman and Leaver Learning Style Questionnaire (E&L). The E&L consists of 10 subscales, each of which comprises three bipolar question items (see Appendix). The Japanese version of the E&L was developed as follows. (1) The author translated the 30 items into Japanese, (2) the Japanese version was sent to the original creators of the E&L, who checked it to make the modified version, and (3) a professor, English teachers, and graduate students who majored in applied linguistics and English education checked the modified Japanese sentences to see whether they appropriately transferred the original constructs. The survey was conducted in several English classes. Participants responded to the bipolar question items on a 9-point scale. The responses on the left column in the Appendix had the lowest score (1) and those

Table 1 *Number of participants and TOEIC score*

	beginner	low-intermediate	high-intermediate	advanced
participants	61	150	117	44
TOEIC score	– 365	365–555	555–690	690 –

on the right had the highest (9). The author instructed the participants to avoid choosing 5 (the very center) as much as possible. The last part of the questionnaire provided the participants with a free-description area for their opinions of the questionnaire and the whole investigation process.

Analytic procedure

In order to investigate the research questions, the first priority of this study was to find a statistically-sophisticated factor structure. Thus, the analytic procedures included the following two steps.

First, a series of exploratory factor analyses (EFA) was conducted. In the process of factor extraction, the EFA employed frequently used criteria such as eigenvalues, scree plot, factor loadings, interpretability for extracted factors, and model fit indices.

Incidentally, as the E&L consists only of a bipolar scale, some particular question items showed bimodal distributions instead of a normal distribution. For example, if higher proficient learners "reacted quickly," while lower proficient learners "took their time to react" (see impulsive 1 and reflective 1 in Appendix), the distribution of the question item would show a valley in the center between two peaks on either side. This may cause some statistical problems since univariate normality is usually regarded as an important requirement for EFA. However, if academic research were obsessed with fancy statistical methodologies without considering the theoretical aspects of what the result scores actually meant, this would result in skewed priorities in the discussion on this topic. Therefore, this study adopted a series of EFA, although there were some variables that did not show normal distributions. It employed the generalized least squares method as a factor extraction process with promax rotation, which can be relatively robust over non-normal distributions.

Second, after the factor-solution processes, the frequency distribution of each factor was investigated based on descriptive statistics and histograms to check whether the extracted factors appropriately represented the cognitive styles of Japanese adult EFL learners.

Results

Exploratory factor analysis

The preliminary analysis removed 10 multivariate outliers based on Mahalanobis distance. The subsequent EFA was conducted with the remaining 362 cases. Generally speaking, a factor analytic process requires more than 300 cases (e.g., Comrey & Lee, 1992; Tabachnick & Fidell, 2007) and the total number of cases in this study still meets the criteria. The descriptive statistics of all 30 items are shown in Table 2.

At the beginning, the EFA adopted a factor-extraction criterion that the eigenvalue be greater than 1.00 (i.e., *Kaiser's criterion*). For factor loadings to be significant, researchers have recommended a minimum value of ±.30 (e.g., Cliff & Hamburger, 1967; Hair, Anderson, Tatham, & Black, 1998), and this study also removed some question items based on this criterion. After repeating EFA several times with these criteria, it then used a four-factor solution referring to the scree plot. The EFA process found one factor consisting of only two question items. This should not be regarded as a successful factor because it suffers from an under-identified model. Moreover, the scree plot then showed the

Table 2 *Descriptive statistics*

	M	*SD*	skewness		kurtosis	
				SE		*SE*
field independent – field dependent 1	5.82	2.28	−0.51	0.13	−0.90	0.26
field independent – field dependent 2	5.25	2.51	−0.19	0.13	−1.25	0.26
field independent – field dependent 3	6.51	2.28	−0.96	0.13	−0.14	0.26
field sensitive – field insensitive 1	5.34	2.19	−0.05	0.13	−1.12	0.26
field sensitive – field insensitive 2	5.39	2.29	−0.14	0.13	−1.06	0.26
field sensitive – field insensitive 3	4.07	2.12	0.53	0.13	−0.80	0.26
leveling – sharpening 1	5.38	2.39	−0.17	0.13	−1.15	0.26
leveling – sharpening 2	4.54	1.92	0.29	0.13	−0.71	0.26
leveling – sharpening 3	4.30	2.06	0.42	0.13	−0.69	0.26
global – particular 1	4.65	2.27	0.10	0.13	−1.12	0.26
global – particular 2	4.97	2.07	0.06	0.13	−0.92	0.26
global – particular 3	3.61	2.15	0.73	0.13	−0.62	0.26
impulsive – reflective 1	5.60	2.57	−0.28	0.13	−1.23	0.26
impulsive – reflective 2	6.05	2.30	−0.66	0.13	−0.60	0.26
impulsive – reflective 3	4.75	2.54	0.06	0.13	−1.27	0.26
synthetic – analytic 1	4.88	2.33	0.05	0.13	−1.26	0.26
synthetic – analytic 2	5.10	2.30	−0.02	0.13	−1.06	0.26
synthetic – analytic 3	4.70	2.16	0.09	0.13	−0.92	0.26
analogue – digital 1	5.10	2.50	−0.03	0.13	−1.26	0.26
analogue – digital 2	4.03	2.31	0.50	0.13	−0.80	0.26
analogue – digital 3	3.37	2.04	0.80	0.13	−0.19	0.26
concrete – abstract 1	3.58	2.08	0.70	0.13	−0.36	0.26
concrete – abstract 2	4.04	2.24	0.46	0.13	−0.85	0.26
concrete – abstract 3	3.51	2.22	0.81	0.13	−0.43	0.26
random – sequential 1	4.04	2.42	0.51	0.13	−0.96	0.26
random – sequential 2	5.02	2.24	−0.09	0.13	−1.05	0.26
random – sequential 3	5.86	2.20	−0.48	0.13	−0.84	0.26
inductive – deductive 1	5.18	2.50	−0.28	0.13	−1.27	0.26
inductive – deductive 2	6.09	2.30	−0.58	0.13	−0.74	0.26
inductive – deductive 3	5.48	2.32	−0.27	0.13	−1.09	0.26

Note. $n = 362$. *M* = mean, *SD* = standard deviation, *SE* = standard error

appropriateness of a three-factor solution. Therefore, the next process employed a three-factor solution. Considering the interpretability of each factor and model fit indices, the final result of EFA is a three-factor model. The Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy was .63, which can be evaluated as "mediocre" (Kaiser & Rice, 1974). The value of significance in Bartlett's sphericity was less than .05 (i.e., it was significant at a 5% level). Those values mean the EFA could appropriately be adapted to the dataset. Moreover, as six residuals (10%) of the reproduced correlations were over an absolute value of .05, the three-factor model showed a relatively good model fit. Further, 33.8% of the variance was explained by the three factors, according to the cumulative percentage before the factor rotation. The first factor was named "impulsive – reflective (access to actual behavior)," the second as "active – passive (cognitive engagement)," and the third as "global – particular (cognitive focus)." The left-hand side of each range (e.g., "impulsive" in the first factor)

means lower scores on the 9-point scale, and the right-hand side (e.g., "reflective" in the first factor) means higher scores. Table 3 shows the factor loadings and communalities of each item and inter-factor correlations.

Frequency distribution of each factor

For the three factors to appropriately represent the cognitive styles of Japanese adult EFL learners, each factor should have a normal distribution and cover a wide range of the 9-point scale. Furthermore, if these characteristics were ensured, the three factors could be used to examine relationships with other aspects such as personality, learning strategies, and proficiency levels. Table 4 presents the descriptive statistics and the results of one-sample *t*-tests comparing the mean score of each factor with the very center value of the 9-point scale (i.e., 5). According to the skewness and kurtosis on Table 4, each factor is normally distributed.[4] However, the one-sample *t*-tests showed that the mean score of impusive – reflective was slightly on the reflective side and that the mean of global – particular was on the global side, while the mean for active – passive is located at the very center of the 9-point scale without a significant difference. Figure 1 shows histograms with the case frequency on the Y-axis and the 9-point bipolar scale on the X-axis. The standard deviation introduced in Table 4 and histograms in Fig. 1 indicate that the distribution covered a wide range of the 9-point scale without clustering within a narrow range.

Discussion

Research question 1

The EFA extracted three unique factors different from the original E&L: impulsive – reflective (access to actual behavior), active – passive (cognitive engagement), and global – particular (cognitive focus). Therefore, the E&L does not show appropriate factorial validity in this study.

Table 3 *Factor loadings, communalities, and inter-factor correlations*

		factor 1 impulsive – reflective	factor 2 active – passive	factor 3 global – particular	communality
Cronbach's *α*		α = .63	α = .58	α = .59	
impulsive – reflective 2		**.89**	.00	–.03	.78
impulsive – reflective 1		**.62**	.00	.03	.40
impulsive – reflective 3		**.39**	–.04	.06	.19
inductive – deductive 2		–.01	**.64**	–.10	.42
inductive – deductive 3		–.11	**.48**	.14	.27
random – sequential 3		.14	**.46**	.02	.28
field sensitive – field insensitive 3		.00	**.44**	–.02	.25
analogue – digital 2		–.05	**.38**	.05	.19
global – particular 1		.02	–.05	**.85**	.72
global – particular 2		.05	.14	**.47**	.28
global – particular 3		–.01	–.01	**.42**	.20
inter-factor correlation	1		.21	.13	
	2			.04	

Note. Factor loadings > | ± .30 | are in boldface

Table 4 *Descriptive statistics and results of one-sample t-tests for the three extracted factors*

	M	*SD*	skewness		kurtosis		*t*-value		*r*	effect size
				SE		*SE*				
impulsive – reflective	5.47	1.88	−0.19	0.13	−0.66	0.26	4.75	**	.24	small
active – passive	5.11	1.38	−0.13	0.13	−0.03	0.26	1.50		.08	little
global – particular	4.41	1.61	0.19	0.13	−0.56	0.26	−6.99	**	.35	medium

Note. $n = 362$. M = mean, SD = standard deviation, SE = standard error
**$p < .01$

The results revealed that the EFA could be applicable to the dataset and that the three-factor solution showed relatively good model fit indices. Besides, the results in Table 4 and Fig. 1 show that all three factors have normal distributions covering a wide range of the 9-point scale. Taking the impulsive – reflective factor as an example, this means that Japanese adult EFL learners are on the continuum from extremely impulsive through extremely reflective and that the question items included in the first factor appropriately represent all kinds of learners in between. On the other hand, the Cronbach's α for each internal consistency was α = .63, α = .58, and α = .59, respectively. Although these values are located around the standard for a good Cronbach's α value (α = .60; Nunnally, 1967), they are still not high enough according to other, newer criteria (α = .70; Nunnally, 1978).

These results indicate that while the new factor structure shows a certain level of validity, it still partly suffers from conceptual ambiguity. Nevertheless, it has a profound meaning for Japanese adult EFL learners, based on the following interpretations with educational and cultural backgrounds.

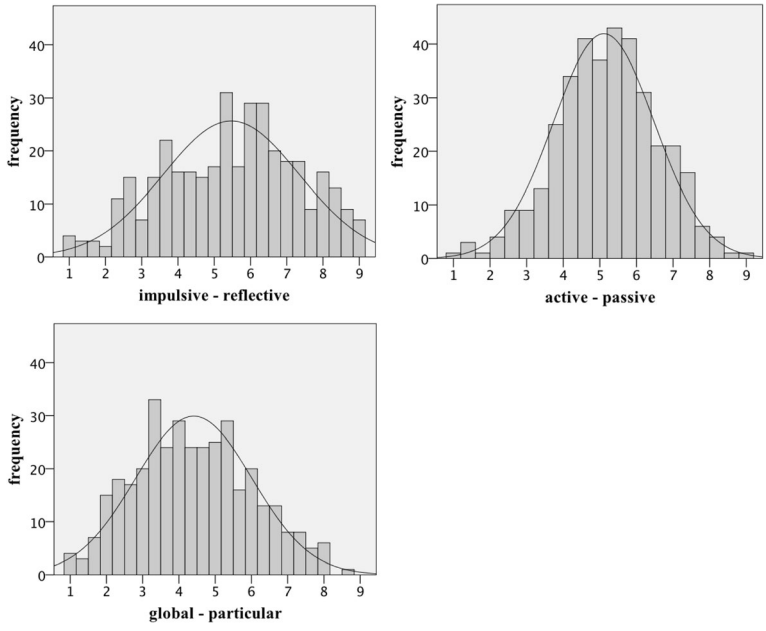

Fig. 1 Histograms of the three extracted factors

Research question 2

Impulsive – Reflective (access to actual behavior)

An original construct of the E&L was replicated for the first factor. According to the original definition of Leaver et al. (2005), impulsive learners "think and respond nearly simultaneously. They tend to complete their work more quickly but often with less accuracy than reflective learners," while reflective learners "think, then respond. They tend to show more involved and deeper levels of thinking. Reflective learners more often than not work accurately, but their slowness sometimes means that work is incomplete" (p. 75).

The most important reason for this factor extraction may be attributed to a Japanese cultural aspect, *cautiousness* accompanied by a feeling of *shame*, experienced in not only general but also educational situations. In one of the earliest studies, Benedict (1946) explained Japanese culture in terms of shame (*haji* in Japanese language). For example, she explained that "[t]hose who do respect themselves (*jicho* [in Japanese language]) chart their course … between 'expected man' and 'unexpected man,' and sink their own personal demands in the collective 'expectation.' These are the good men who 'know shame (haji)' and are endlessly circumspect" (p. 293). Following some native researchers' criticism or supplemental explanation (e.g., Sakuda, 1967; Uchinuma, 1983), this idea still seems to be regarded as one of the most important cultural values ingrained in modern Japanese people, who generally emphasize on becoming harmonized with others and atmosphere at a given situation.[5] Thus, in order to meet the collective expectation, some of them tend to take time before responding. This cultural feature appears to lead people to cautious behavior that can also be frequently seen in current educational settings. For example, Doyon (2000) adopts the following explanation to describe the cause of Japanese learners' shyness: "[f]or many Japanese people in many situations, there seems to be an intense fear of making mistakes" (p. 14) and points out the influences of the fear in a language class. Furthermore, the description of Saito and Eisenstein Ebsworth (2004) also illustrates the current classroom situation in Japan: "[m]any students do not volunteer unless they are sure that their answers are correct" (p. 112). Some Japanese learners of English might take time to become an "expected" person, who could provide a right answer, assuming that it would be embarrassing to make a mistake in front of others, or who could avoid distracting the class with a wild statement, believing that it would disgust classmates. In this type of value, learners might have taken on a cognitive style represented as "reflective." For learners to render accuracy and correctness to what they say and do, they tend to "take their time to react" and "think about things before they do or say" (see reflective 1 and 3 in Appendix). Some learners are, of course, naturally impulsive and free from the effects of this type of pressure. However, as the mean score (i.e., $M = 5.47$) was positioned on the reflective side with statistical significance and a certain effect size (Table 4), the value still seems to have a certain impact favoring the development of the reflective style. Thus, cautious behavior to cope with the cultural aspect represented also in educational settings is probably one of the reasons that the bipolar factor of impulsive – reflective was extracted for Japanese adult EFL learners.

Active – Passive (cognitive engagement)

The active – passive factor consists of mixed items from each different part of the original E&L. Thus, the original concepts were reassembled into a new factor. Considering the five

items included, it is interpreted as the extent to which each learner actively or passively processes information input. Above all, the factor is related to such information processing as making a connection (or not) between new and existing information, reconsidering (or not) existing concepts, and deeply exploring (or not) principles and rules.

This factor extraction could also be attributed to educational and cultural features in Japan. While the current English education policy has started focusing on communication skills (Ministry of Education, Culture, Sports, Science and Technology-Japan [MEXT], 2010a, 2010b), it is still seriously bounded by university entrance examinations, which introduced what is called "exam hell," in which great attention is paid to the grammar-focused approach (Ushioda, 2013, p. 5). Therefore, while various styles of entrance examination have been implemented, such as an Admission Office style,[6] the educational system is still trying to cultivate the abilities needed to answer particular styles of questions quickly and accurately. Teachers in junior and senior high schools and cram schools usually analyze past entrance examinations and anticipate the questions that will be provided in the following year and they tend to focus on imparting the knowledge to their students. In addition, this teaching style could easily correspond to the passivity that some Japanese learners might possess as their cultural feature. People in Japan generally tend to inhibit their own expressions and personal demands to live up to others' expectations (Benedict, 1946; Zimbardo, 1977). Besides, Lebra Sugiyama (1987) states that Japanese sometimes hesitate to express strong emotions and opinions for the purpose of social discretion. In other words, they are required to know "what can and cannot be said to whom in what situation" (p. 348). While, as mentioned above, it serves as an important cultural value for modern Japanese people, it possibly creates a passive style of their learning processes. More specifically, in the learner-teacher relationship, where a teacher would occasionally have more power than learners, some Japanese learners of English may tend to underestimate themselves as powerless individuals who should not express strong opinions and regard the teacher as a person who would directly give necessary information and knowledge mostly in one direction. Therefore, referring to the five items included in the active – passive factor, we could speculate that the required cognitive styles for these types of English learning in Japanese culture are "I accept what is presented to me and take it pretty much as presented," "I prefer to use rehearsal and repetition," "I prefer to get the grammar rules from the teacher or a book (instead of figuring out for myself)," and "when learning, I would rather learn what I need to know directly, without fumbling around" (see field-insensitive 3, digital 2, deductive 2, and deductive 3 in Appendix). On the other hand, there should be some teachers who try hard to develop learners' active engagement even in the entrance examination-oriented education system. Besides, some but not many classes, curricula, and schools in Japan have provided opportunities for more practical and communicative English use that requires learners to become more actively engaged. One example is a Diploma Programme in the International Baccalaureate (IB), which involves classes in a number of subjects (e.g., mathematics, science, and social studies), conducted in English or other foreign languages. The Japanese government has started a campaign to increase the number of authorized IB schools (MEXT, 2011). In such classes, as learners are exposed to a large amount of English input, output, and interaction in succession, with authentic contents, they have to try "to figure out grammar rules for themselves" and "make guesses and then seek evidence to confirm or modify their ideas" (see inductive 2 and 3 in Appendix). Furthermore, there are some learners whose cognitive style is innately active. For this reason, the educational and

cultural backgrounds in Japan could easily produce the dichotomy of active – passive cognitive engagement. Learners might usually take on one of the styles represented in the second factor through their experiences.

Global – Particular (cognitive focus)

As this factor consists of three items originally included in the E&L's global – particular factor, this factor has adopted the same name and definition. Leaver et al. (2005) explain the factor thus:

> Learners who prefer global processing attend to an image as a whole (as opposed to its parts). For them, the most important thing is seeing and understanding the "big picture." Informally, we often distinguish between people who "see the forest" and those who "see the trees." Global learners are the ones who see the forest and may miss the trees. The process information in a "top down" manner, focusing on overall meaning first and details later – if at all. If they miss enough details, the meaning that they "invent" can stray quite far from reality. (pp. 74–75).

> Students who display particular processing are attentive to discrete items and details. They are aware of the various kinds of "trees," rather than the forest *per se*. Their processing of information is "bottom up," seeing the form first and the general meaning second. Sometimes the details become important to them independently of any relationship to larger concepts, creating a different kind of difficulty for them. (p. 75).

The third factor can be explained based on the current educational approach and the Japanese cultural perspective. While English education in Japan has gradually changed to focus on communication skills (e.g., MEXT, 2010a, 2010b), the traditional approach highlighting particular details is in fact still prevalent in many situations. For example, if learners miss the third-person singular *-s* or use an inappropriate preposition in English writing, the whole answer will sometimes be seen as incorrect (i.e., students cannot possibly get any points for the question) even though the meaning delivery of the sentence is not impeded by such small grammatical mistakes. This type of feature might make learners focus on details and small differences. Furthermore, this type of educational approach would strictly count learners' mistakes and increase the number of cases where learners would feel shame (haji) about their wrong answers. According to the discussion above (Benedict, 1946), some Japanese learners of English tend to make as much effort as possible to avoid making mistakes (Doyon, 2000; Saito & Eisenstein Ebsworth, 2004), because they hope to become an "expected" person who could give the right answer and avoid feeling shame. The mixture of these educational and cultural aspects possibly encourages some learners to be much more attentive to discrete items and details. On the other hand, of course, there are some learners who are blessed with the current educational trend of communicative approach without much focus on particular details and who cannot but grasp the whole picture as an innate global learner. Therefore, it seems reasonable to conclude that the dichotomy between global and particular was extracted in this study partly based on the educational and cultural perspectives in Japan.

Incidentally, although the mean score would appear on the particular side if the interpretation above were valid, in fact Japanese adult EFL learners seemed to fall on the global side

with a mean score of 4.41, which shows a significant difference from the very center, $p < .01$. This might be caused by the following self-evaluation bias. As stated above, whereas English education in Japan is in an embryonic period in which more diverse approaches (e.g., the Diploma Programme of the IB) are being tried, most learners are forced to undergo the traditional approach in many situations. Thus, they are still required to pay attention to small and particular parts, even though it is quite difficult to perfectly respond to the request. For example, anyone can make a small mistake with the third-person singular *-s*, but among educators, this is sometimes seen as a serious mistake and marked as an incorrect answer with some penalties. Therefore, learners might make the self-evaluation that they cannot be aware of such a small detail. This feature might be represented in the mean score of this factor. In other words, although they have already had cognitive styles which let them focus on particular points and details, they cannot evaluate themselves as particular learners due to a kind of perfectionism. As a result, the mean score of the self-evaluation could thus fall on the global side. Hence, the true mean score might be at the very center or even on the particular side.

Removed question items

The factorial validation process extracted three factors particular to Japanese adult EFL learners with 11 question items. This section discusses three important points for the 19 items that were removed. First, this does not necessarily mean that the 19 items are not important. The results might just show that the three extracted factors are probably more essential to general Japanese adult EFL learners. The removed items could be crucial to other learners from different cultural or educational backgrounds, or to some particular individuals even among Japanese adult EFL learners. Therefore, in practical use, it would be better for target learners to respond to all 30 items of the E&L, and researchers and instructors should particularly focus on the question items in the three factors.

Second, the item reduction does not deny the importance of the removed theoretical concepts. For example, although the present study removed all the question items for "field independent – field dependent," one of the frequently discussed concepts in L2 learning, it is sometimes necessary for Japanese adult EFL learners. We may speculate that one reason for this item reduction is that the original question items or the translated Japanese sentences still include some problems. The participants wrote about difficulties in responding to some of the removed items in the free-description area of the questionnaire. The main descriptions included, "it is difficult to understand the question" and "the question does not look like a dichotomy." Thus, after development of an updated version of the questionnaire, the removed theoretical concepts in this study (e.g., field independent – field dependent) might be duplicated through another series of EFA.

Third, the result after removing certain items does not necessarily rebut the synoptic – ectenic concept. The superordinate bipolar concept still seems to bundle each question item of the three factors extracted in this study. Considering the active – passive factor, for example, active learners still possibly have the synoptic feature (i.e., being reliant on intuition and subconscious control), while passive learning seemingly holds the ectenic feature (i.e., occurring under the conscious control of the learner). However, because quite a different factor structure was introduced in this study, we should reconsider the current theoretical structure of the synoptic – ectenic dichotomy.

Pedagogical implications

One of the main goals of a validation process including factor analysis is, of course, to provide learners with more appropriate support for their actual L2 learning. This section introduces some practical uses of the three factors. The first issue is how to use them in classroom situations. Taking the active – passive factor as an example, if instructors want learners to become more active, each question item could work as an ideal learner model, who can "learn by using lots of associations" or "find a way to use the material they are learning" (see analogue 2 and random 3 in Appendix). Instructors could then create actual tasks to realize these ideal learner models. For example, in order to encourage learners to "learn by using lots of associations," instructors should provide opportunities for English presentations related to some units in the textbook (e.g., globalization and cultural diversity) with a more general theme such as social issues. Further, in order to let learners "find a way to use the material they are learning," instructors should show them more general learning strategies that could be applicable to the learning processes for the textbook they are using (e.g., Oxford, 2011).

Secondly, the concept of cognitive styles is also beneficial in one-on-one learning support programs. There is a recently developed approach called advising in language learning (ALL) in the area of applied linguistics (Carson & Mynard, 2012), whose main purpose is to cultivate an autonomous learner. Advisors usually provide learners with opportunities to monitor and control their own characteristics in English learning through dialogues and tools such as a questionnaire. For example, in the case of learners trying to improve their TOEIC scores, advisors will encourage them to think about such questions as "which learning strategies are more effective," "when do they take time in their daily schedules," and "what is the main goal for them to take TOEIC?" In such a process, learners consider various personal factors, including their cognitive styles. For instance, learners might think about the more effective learning strategies that match their cognitive styles, try to change their own styles to achieve their new learning goals, or try to identify the benefits of their own styles when they perceive difficulties in changing them. Therefore, the three factors extracted in this study could function as a diagnostic tool in ALL services for Japanese adult EFL learners. In fact, Ehrman and Leaver (2003), the developers of the E&L questionnaire, provided advisory services for adult learners in the Foreign Service Institute in the United States using the original questionnaire.

Conclusions and future directions

This study successfully provides an essential factor structure of cognitive styles for Japanese adult EFL learners. The EFA processes extracted three factors: impulsive – reflective (access to actual behavior), active – passive (cognitive engagement), and global – particular (cognitive focus), which have been discussed in terms of Japanese cultural and educational backgrounds. This section introduces three major limitations of this study for future research.

First, although the present study adopts factor analytic processes only for Japanese adult EFL learners, cognitive styles should also be reconsidered in other local situations. Findings accumulated in that manner should be assembled into a bigger picture that can be compared with the existing theoretical concepts, as a result of which the research can be significantly advanced.

Second, although this study used a large-scale questionnaire survey, the data reliability still remains unclear since the participants responded to each question based only

on their subjective self-evaluation. In order to triangulate data types, future studies should introduce other types of methodologies such as computer-based cognitive tasks or qualitative datasets based on interviews, for greater detail.

Third, while this study describes a discussion of stability – stretchability, it does not refer to any empirical data regarding this matter. In previous findings, while many researchers have expressed their opinions on this issue, there has been very little empirical study (e.g., Griffiths & İnceçay, 2016). However, as mentioned in the literature review, this issue would be very important for the purpose of applying the concept of cognitive styles to practical situations. Thus, future research should focus on empirical data to investigate whether and how cognitive styles are stable or stretchable.

Lastly but most importantly, we should bear in mind that the research slowdown in the academic field of learning and cognitive styles does not necessarily mean that the matter is not important. We should acknowledge that this is due to our insufficient knowledge and should not ignore learning and cognitive styles as an immaterial phenomenon. This might be the most important mindset for us to obtain a better understanding of learning and cognitive styles.

Endnotes

[1]According to the School Basic Survey by the Ministry of Education, Culture, Sports, Science and Technology-Japan (MEXT), the enrolled undergraduate students from 2009 through 2013 consisted of 41.5% female and 58.5% male students on average.

[2]Participants who did not take the placement test were classified into one of the four proficiency levels in consultation with the English teachers in charge of the classes where the recruitment occurred.

[3]TOEIC is "an English language proficiency test for people whose native language is not English. It measures the everyday English skills of people working in an international environment" (Educational Testing Service, 2013, p. 2). Since the placement test measures different English performances than those assessed by TOEIC Listening & Reading, the converted scores should still be regarded as approximate indications.

[4]Skewness and kurtosis were converted to z-scores to see if each factor showed normality. The z-scores were calculated by dividing the value of the skewness or kurtosis by the standard error. The z-scores of skewness and kurtosis for the first factor were − 1.46 and − 2.54, for the second factor − 1.00 and − 0.12, and for the third factor 1.46 and − 2.15, respectively. As an absolute value greater than 2.58 is significant at $p < .01$ (e.g., Field, 2009), the null hypothesis was accepted for normal distributions of all three factors at a significant level.

[5]Although Benedict (1946) is one of the world's well-known arguments on Japanese culture, it has faced criticism or supplemental explanation ever since it was made (e.g., Sakuda, 1967; Uchinuma, 1983). While the present study refers to it for international readers to understand an essential framework of Japanese culture based on the well-known literature, it does not agree with all the ideas described in Benedict (1946). Some of them, in detail, would not necessarily be an appropriate explanation of Japanese culture.

[6]MEXT: *Heisei 28 nendo daigaku nyūgakusha senbatsu jisshi yōkō* [FY2016 University Entrance Examination Requirements], Unpublished. clearly mentioned that the Admission Office style should focus on examinees' multiple aspects including ability, aptitude, motivation, and interest, not relying too much on their knowledge and skills measured in the written exams of each subject.

Appendix

Table 5 The Ehrman and Leaver Learning Style Questionnaire (Ehrman & Leaver, 2002)

	synoptic	ectenic
	field independent	field dependent
1	I don't usually get much from the context unless I pay close attention to what I'm doing.	When I work with new language in context, in stories or articles or at sentences; I often pick up new words, ideas, etc., that way, without planning in advance.
2	I usually have to undertake focused study before I learn new words or phrases. I wouldn't describe myself as someone who learns by 'osmosis.'	I often find that I have picked up new words, phrases, and so on without realizing it.
3	I don't like to have to learn from just conversations, informal language use, or readings for native speakers that I haven't been prepared for.	I learn best from language that is in meaningful context like stories and conversations.
	field sensitive	field insensitive
1	When working with new material with additional subject matter around it, I comfortably find and use what is most important.	When there is a lot of information that comes with what I need to learn, it's hard to tell what's most important. It all seems to fall together sometimes, and it's hard work to sort things out.
2	I like out-of-context material like grammar rules.	Grammar rules and pieces of language that are out of context are hard for me to work with.
3	When faced with new language, I reconceptualize it so that it makes sense in my own terms.	I accept what is presented to me and take it pretty much as presented.
	leveling	sharpening
1	I like to reduce differences and look for similarities.	I like to explore differences and disparities among things.
2	I notice mostly how things are similar.	I quickly notice differences, even fairly fine distinctions.
3	I tend not to remember small distinctions, such as those between similar-seeming words or symbols.	I have a good memory for fine distinctions such as those between similar-seeming words or symbols.
	global	particular
1	I tend to be most aware of the 'big picture;'	I notice specifics and details quickly.
2	I notice the 'forest' before the 'trees.'	I tend to be aware of the 'trees' before the 'forest.'
3	I start with the main points and work down to the details.	I begin with the details to work up to the main points.
	impulsive	reflective
1	I react quickly.	I take my time to react.
2	I don't have to spend much time preparing for something; instead, I start off working immediately.	Before starting anything, I want time to orient myself to it.
3	I often act or speak without thinking about it.	I tend to think about things before I do or say them.
	synthetic	analytic
1	I understand best by assembling what I'm learning into a whole.	I understand best by disassembly of what I'm learning into its component parts.
2	I often make up new words or sentences using language I already know.	I seek to understand the system that is behind words and sentences by pulling them apart in my mind.
3	I sometimes make up new ways to say things.	I prefer figuring out how words and sentences are put together.
	analogue	digital
1	I tend to learn things through metaphors.	I like it when people say what they mean directly.
2	I prefer to learn by using lots of associations.	I prefer to use rehearsal and repetition.
3	It helps to understand the meanings behind the actual words.	It's usually okay to take what I'm learning at face value.
	concrete	abstract
1	To learn, I like to interact with the world.	I like to learn through concepts and ideas.
2	I like to learn through applying knowledge and	I like to learn through descriptions and grammars that

Table 5 The Ehrman and Leaver Learning Style Questionnaire (Ehrman & Leaver, 2002) *(Continued)*

	synoptic	ectenic
	theory.	formally represent knowledge.
3	I like learning when I can touch, see, or hear.	I prefer to learn abstractly through theories.
	random	sequential
1	I learn best when I can work out for myself the best sequence to use, even if it's different from the one in the book or lesson.	I learn best when there is a sequence of steps provided, so I can do things in order.
2	Too much emphasis on a curriculum or textbook can get in the way of my learning.	Organized textbooks and lesson plans really help me.
3	It doesn't matter if the material I'm learning isn't very organized; I can find a way to use it.	It's important to go step-by-step as I learn.
	inductive	deductive
1	When I learn, I mostly start with examples or my experience and make generalizations or rules.	When I learn, I mostly start with rules and generalizations and apply them to my experience to learn.
2	I like to figure out grammar rules for myself.	I prefer to get the grammar rules from the teacher or a book.
3	When learning, I make guesses and then seek evidence to confirm or modify my ideas.	When learning, I would rather learn what I need to know directly, without fumbling around.

Note. The Appendix was created with permission

Abbreviations

ALL: Advising in language learning; CAT: Computerized adaptive test; CEFR: Common European Framework of Reference for Languages; E&L: Ehrman and Leaver Learning Style Questionnaire; EFA: Exploratory factor analysis; EFL: English as a Foreign Language; IB: International Baccalaureate; IRT: Item response theory; KMO: Kaiser-Meyer-Olkin; L2: Second language; LSS: Learning Style Survey; M: Mean; MEXT: Ministry of Education, Culture, Sports, Science and Technology-Japan; SAS: Style Analysis Survey; SD: Standard deviation; SE: Standard error; SILL: Strategy Inventory for Language Learning; TOEIC: Test of English for International Communication

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Availability of data and materials

Please contact author for data requests.

Authors' contributions

This study was carried out by a single author. The author designed the study, reviewed the literature, collected and analyzed the data, and wrote and approved the final manuscript.

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