An Exploratory Factor Analysis of Scores Generated by the Kambara Locus of Control Scale in the Japanese High-School Population

Michael J. Rupp

Abstract

Using data gathered from 1125 Japanese high school students, this study reports on an exploratory factor analysis (EFA) conducted on the Kambara Locus of Control Scale (K-LoC), a widely use instrument for measuring locus of control (LoC) in the Japanese research context, which was created by Kambara (1982, 1987). This research aims to contribute towards a larger research theme of heretofore unsuccessful attempts at measuring learner autonomy (LA) with respect to second language English students in Japan; and does so on the theoretical assumption that LoC and LA are related constructs. The purpose of the EFAs was to gain post hoc insight into the structure of scores generated by the K-LoC after an earlier study using confirmatory factor analysis (CFA) conducted by the author (Rupp, 2016a) revealed that scores showed poor model fit to the author-hypothesized model for the instrument. A secondary purpose was to align some of the insights gained in a qualitative focus group analysis (separate sample) conducted by the author (Rupp, 2016b) with the results for the EFA reported in this paper. The results of the EFA supported the notion that the scale would benefit from having a reduced number of items.

The Locus of Control Construct

Locus of control (LoC) is a psychological construct that originated from Julian Rotter, having its roots in Social Learning Theory (Rotter, 1954; Bandura, 1977). Rotter's idea was that people tend to view events as resulting either from their own actions or from external forces. "Locus" is the Latin term meaning place, and a person's LoC can be described as being placed on a continuum ranging from external to internal. LoC refers to the extent to which someone believes they are in control of their lives, and was conceived of as having the sub-dimensions of internal locus of control (I-LoC), which is the belief that one is in control of outcomes in one's own life, and external locus of control (E-LoC), which is the belief that outcomes in one's life are externally controlled. In the case of E-LoC, there are two further sub-dimensions: (a) random events or fate as the external source of control, and (b) powerful others as the external source of control.

In the EFL learning context, students scoring higher in I-LoC were demonstrated to have better ability at taking control of their own learning (Ghonsooly, 2010), which is one of the key components of learner autonomy. Although it is generally viewed that having a high degree of I-LoC is a positive trait, in can also have negative aspects as well, for example an overly internally oriented person might tend towards neuroticism or excessively blame themselves for failure. Likewise, although external orientation is usually seen as too passive and fatalistic for high levels of success, highly external students can sometimes benefit from having a happy-go-lucky, easygoing attitude towards life.

The construct of LoC is a member of a group of constructs notionally related to learner autonomy (Duttweiler, 1984), such as attribution theory (e.g. Heider, 1958; Kelley, 1967; McLeod, 2010), self-efficacy theory (Bandura, 1977), and self-determination theory (Deci & Ryan, 1985), having a strong parallel with the agency component of learner autonomy. Self-determined behavior has been linked with other autonomy-supportive behaviors such as increased intrinsic motivation, interest, and learning (Deci & Ryan, 1987). In order to have agency, or the power to control one's self (Oxford, 2003), one would necessarily have to believe that one's actions can influence outcomes, which is the very definition of I-LoC. Thus, possessing a high degree of I-LoC should associate with greater degrees of learner autonomy. Oxford (2008) states that "individual learner autonomy is reflected in a cluster of related concepts: agency, locus of control, attribution of outcomes and self-efficacy" (p. 49) and, citing Fazey and Fazey (2001), that "internal locus of control is one of the characteristics of autonomy."

LoC has been conceptualized as referring to a unidimensional continuum which ranges from external (E) to internal (I) (Neill, 2006). Rotter (1966) developed the first LoC scale in 1966 as a 29-item forced choice questionnaire, with six filler items, which was a measure of general LoC, as opposed to the domain-specific scales which came into increasing use later. Rotter (1975, 1990) emphasized that LoC is not a binary typology, but rather represents points on a continuum; i.e. it is not an either/or proposition. While locus of control is generally expected to predict behavior in various situations, there can be domain specific situations wherein people switch from behaving more as internals or more as externals. This would include domains in which the person has substantial skills and experience, or conversely a lack thereof. Domains in which LoC scales are frequently used include: (a) education, i.e. for student and teacher evaluations; (b) business, i.e. for employee evaluations; (c) health, i.e. to predict patient outcomes through protocol compliance; and (d) psychology, i.e. for the psychiatric evaluation of prisoners, parents, and children (Halpert & Hill, 2011).

As LoC can vary according to domain, it is generally viewed as preferable to employ domain-specific scales rather than general measures (Borich & Paver, 1974; Dixon, McKee & McRae, 1976; Fournier & Jeanrie, 1999; Lefcourt, 1991; Paulhus, 1983; Spector, 1992). Nevertheless, Rotter's scale has been, and continues to be, widely used in many domains and across cultures. Examples of this diverse deployment would include its use in the Chinese population (Tong & Wang, 2006), as well as its use to measure alcoholic treatment receptivity (Cavaiola & Strohmetz, 2009) and in the analysis of aggression in South African boys (Breet, Myburgh, & Poggenpoel, 2010). However, there have been criticisms that Rotter's use of filler items is unnecessary and does not sufficiently deter the test takers from answering how they think they should answer (Kestenbaum & Hammersla, 1976).

One popular LoC scale, which was created to overcome perceived deficiencies in Rotter's original scale, is known as the Duttweiler Internal Control Index (Duttweiler, 1984; Furnham & Steele, 1993). Another widely used LoC scale is the Reid-Ware Three-Factor Internal-External Scale (Reid & Ware, 1974), which is a 45-item forced choice scale which divided the LoC construct into three sub-dimensions: social system control (akin to powerful others), fatalism, and self-control. It has been used in domains ranging from studies about anorexia (Hood, Moore, & Garner, 1982), intimacy (Prager, 1986), hostility (Sadowski & Wenzel, 1982), death anxiety (Sadowski, Davis & Loftus-Vergari, 1979), self-esteem (Sadowski, Woodward, Davis, & Elsbury, 1983) to student exam scores (Gilmore & Reid, 1978). Though enjoying widespread use, this scale was also criticized for being too long and it was noted to have produced better results when shortened (Dragutinovich, White & Austin, 1983; Ross, Kalucy & Morten, 1983); an important finding which resonates strongly with the findings in the present study, to be covered below, namely that the short form of the K-LoC (Kambara, 1982) is arguably better than the later-developed long form (Kambara, 1987).

The Kambara LoC Scale in the Japanese Learner Context

In the Japanese literature, an LoC scale which emerged prominently was the scale created by a Japanese researcher, Masahiko Kambara, who specialized in educational psychology. His scale is referred to here as the Kambara Locus of Control Scale (K-LoC). This scale was created to investigate the LoC levels of Japanese high school students. It was originally an 18-item questionnaire (Kambara, 1982), and in this study the 18-item version is referred to as the K-LoC18. This 18-item version was later expanded to 43 items (Kambara, 1987), and this version is referred to in this study as the K-LoC43. See the Appendix for the full 43-item version and the associated English translations of each item (these translations are there for the reader, and it was the Japanese version which was used in this study to collect data). Note that the first 18 items of the K-LoC43 are, in fact, the 18 items comprising the K-LoC18. In other words, the revision to a 43-item instrument essentially involved the appending of an additional 25 items to the original 18-item version.

It is this longer version, the K-LoC43, which has been predominantly used for the last 30 years in Japan; with studies using it appearing in a wide variety of domains, ranging from developmental psychology (e.g. Kanda, 2006), educational studies, including English achievement (e.g. Hosaka, 2007; Kambara, 1987), to studies about employee psychological distress (e.g. Fushimi, 2011). The significant presence of this instrument in the literature made it a good candidate for investigation by the current author (Rupp, 2016a, 2016b) because cumulated research inferences have been based on the scores it has produced. Also, given that learner autonomy has proved hard to measure in English as foreign language research, and given that LoC is notionally and theoretically related to autonomy, the K-LoC43 was identified as having good potential for measuring LoC as a proxy for learner autonomy.

However, results from a confirmatory factor analysis (CFA) reported in Rupp (2016a) indicated that the measurement model hypothesized for the instrument by the original author (Kambara, 1982, 1987), and instantiated in the instrument's scoring regime, did not fit the dimensionality of scores produced by the instrument in a sample taken from three Japanese high schools. Additionally, a model which had been suggested by an a posteriori EFA analysis conducted by (Hosaka, 2007) also did not fit the dimensionality of scores produced in the sample collected by Rupp (2016a). The CFA models tested and reported in Rupp (2016a) constituted a priori tests of the available measurement models which have featured in the literature thus far. The present study reports on EFA analyses later conducted on the Rupp (2016a) data as a posteriori analyses. These a posteriori analyses conducted subsequently and after suggestion by supervisory peers, proceeded under the question as to what the underlying structure of the scores actually was, if it was not consistent with the a priori models tested in the earlier CFAs.

Methodology

The methodology is reported in terms of the instrument under study, the participants, the data collection procedure, and the analytical procedure. EFAs were conducted on both versions of the K-LoC; the original short version or K-LoC18 and the more widely used long version or K-LoC43.

Instrument

The long form of the Kambara Locus of Control Scale (K-LoC43) comprises 43 statements (see Appendix) for which students answer on a 4-point Likert scale which ranges from strongly disagree to strongly agree. The scale was originally created in Japanese by Kambara (1987), a native-speaker of Japanese, and thus there was no need to alter the language of the original scale. As the scale was originally created for Japanese high school students it was decided to collect the sample from this population. The Short Form (K-LoC18) comprises the first 18 items from the K-LoC43. In other words, and as stated earlier, the K-LoC43 was developed by adding a further 25 items to the earlier K-LoC18.

Participants and Procedure

There were 1223 total participants in this study with 98 responses removed for having missing data. This data was missing at random and therefore removing these cases did not systematically affect the sample. This process left 1125 usable responses (N = 1125). The participants were Japanese high school students of both sexes with 57% male and 43% female respondents. The percentage of responses according to high school grade was 56% for first year, 10% for second year and 34% for third year, with a mean age of 16.44 years. The data was collected from two private high schools and one public high school. Participation was voluntary and had no effect on the students' grades. The consent form was printed at the top of each questionnaire which clearly stated in Japanese that those who did not wish to consent could freely do so by merely not completing the questionnaire. Permission to administer the questionnaires was given by each of the high school's principals and the questionnaires were anonymous. The time required for administration was approximately 15 minutes.

Analytical Procedure

The analytical procedure is divided into two parts, descriptive statistics and the EFA. The data collected from the students was stored in a Microsoft Office Access 2007 database. Descriptive statistics and reliability estimates (Cronbach's alphas) were calculated using the IBM/Statistical package for the Social Sciences (SPSS) software Version 20.0. The CFA was performed using Analysis of Moment Structure (AMOS) version 18.00.

Descriptive Statistics

The data was first considered from the point of view of descriptive statistics focusing on univariate normality (i.e. skew and kurtosis). Descriptive statistics encompass a summary of the data set, usually including the sample size (*N*), mean, standard deviation, and normality. When deciding the appropriate sample size for structural equation modeling (SEM), the recommended minimum ratio of participants to items is 10:1 (Hair, Anderson, Tatham & Black, 1998). Thus, for example, the long form of the instrument under consideration in this study, the K-LoC43, which comprises 43 items, should therefore have a minimum sample size of 430 participants. Kline (2011) has demonstrated that having sample sizes which are lower than this minimum recommendation yield results with lower statistical power. The method for evaluating skew and kurtosis was to calculate the critical ratio by dividing the value for skew and value for kurtosis by the respective standard error in the case of each of the 43 items. In order to evaluate the skew and kurtosis, the author stipulated, in advance, a minimum evaluation criterion of 3.0, as well as a stricter criterion of 2.0, to identify meritorious results. It is recognized that the data is quite coarse, being on a four-point scale, for this kind of analysis.

Normality

Normality of distribution of scores in a data set, i.e. when scores tend to cluster around the mean in the normal or bell-shaped curve, is important as many statistical tests are based on an assumption that this is the case. If the data varies too far from the normal distribution, then tests which assume this distribution will necessarily lack validity (Hair et al., 1998). The two indicators used to determine normality, or lack of normality, are the critical ratios for skew and kurtosis.

Skew refers to a nonsymmetrical distribution of scores which is shown graphically by a tail pointing towards either the higher or lower scores. When pointing towards the lower scores it is said to be skewed negatively with the majority of the scores falling above the mean, and when pointing towards the higher scores it is said to be skewed positively, with the majority of the scores falling below the mean (Brown, 1998). When the data is obtained from Likert scales, the assessment of skew can be affected by the scale not being as refined as it needs to be to measure what is trying to be measured and thus may require adjustment.

Kurtosis indicates the degree of flatness of the peaks in the score distribution, with excessively-peaked distributions being referred to as positive kurtosis and excessively-flat distributions as negative kurtosis. In the case of kurtotic data gathered from Likert scales, positive kurtosis may indicate that the respondents did not know how to reply to the item, or may have just chosen neutral responses to save time or avoid cognitive effort. The Likert scales for the K-LoC43 and K-LoC18 do not have a neutral response, but one could still presume responses to occur around the two central points on the scale when the above two problems exist. When a researcher encounters skewed or kurtotic distributions, it may be required to evaluate the items suitability and possibly discard or reword the items in a revised instrument in order to avoid getting bad data.

As visual evaluation of graphs of data for skewness and kurtosis can be subjective, there are a number of statistical approaches that may be used to get a more objective view of the normality of the score distribution. In this study, univariate normality, as mentioned above, is inspected using the critical ratio for skew and kurtosis and comparing this against a predetermined threshold or cutoff. With respect to multivariate non-normality, Mardia's test (1985) for multivariate nonnormality is used in this study with awareness that it is often criticized for being overly sensitive. With respect to univariate normality, there is some disagreement among researchers on the suggested values to use for acceptable thresholds or cutoffs, with some having suggested poor results as being indicated by > 7.0 for kurtosis and > 2.0 for skewness (Curran, West & Finch, 1996). However, a more stringent recommendation of ±2.58 for both values was suggested by Hair et al. (1998), with others such as Kline (2011) suggesting relatively relaxed thresholds of > 10.0 for kurtosis. This study adopts a two-criteria approach of reporting a stringent threshold of > 2.0 and a relaxed threshold of > 3.0, for both skewness and kurtosis.

Cronbach's Alpha

Cronbach's alpha (Cronbach, 1951) is one of the most frequently reported indexes in test creation (Cortina, 1993), being an estimation of the reliability of scores generated by psychometric instruments (Schmitt, 1996), and is used as a coefficient of internal consistency

(Brown, 1998) showing the degree of interrelatedness among items. It is based on the theory that the scores obtained from participants (X) should be equal to their true scores (T), plus a margin of error (E), or X = T + E. The value for Cronbach's alpha shows the squared correlation between these scores and is expressed as an index ranging from 0 to 1.0 (Nunnally & Bernstein, 1994). As the value of the index approaches 1.0, the correlation is higher, and thus so is the reliability, and conversely, as the value of the index approaches 0, the correlation is weaker and likewise is the reliability. The widely accepted threshold for evaluating the reliability of an instrument is .7, as recommended by Nunnaly and Bernstein (1994), though there have been criticisms when the test has been misused as a measure of unidimensionality or homogeneity (Miller, 1995). This is due to confusion by what is meant by interrelatedness, or correlation among test items, and unidimensionality, which is a different concept, indicating that all items are measuring the construct they are claimed to measure and no other. There is also a predisposition for higher alpha scores when there are more items in a scale (Cortina, 1993; Schmitt, 1996), meaning that scales which have many items per construct may be overrated in terms of reliability by Cronbach's alpha. The reason Cronbach's alpha is reported in this study is due to Nunnally and Bernstein (1994) recommending that it be reported for all tests, both for estimating reliability, and also for test modification purposes, as well as its widespread use in the field of applied linguistics. However, while it is reported in this study, it is done so with the realization of its deficiencies, many of which can be overcome by using CFA (see Rupp, 2016a) to examine the dimensionality of the data.

Exploratory Factor Analysis

EFA was conducted on both the long form, K-LoC43 and the original short form, K-LoC18, using the IBM/Statistical package for the Social Sciences (SPSS) software Version 16.0. In contrast with CFA analysis, this analysis is post hoc or a posteriori, meaning that the purpose of the analysis is not to test the data against an a priori model. A priori in this case can mean either: 1) a priori in the sense of being theoretically driven or, 2) a priori in the sense of being informed by post hoc results from previous studies available in the literature. In EFA the aim is rather to explore what latent structure might be present in the data in a manner which is led by the data itself, and it is thus bottom up in approach and in contrast with the top down approach of the CFA. The results from an EFA are not fully determinate as is the case with results from a CFA, and they are only indicative of a structural model which probably underlies the scores in dataset. CFA is a direct test of the plausibility of a hypothesized model against the dimensionality of scores in a dataset. In EFA the results are to be viewed as contingent; meaning they are contingent upon decisions made in a decision sequence followed for the purpose of allowing the latent structure to emerge and be characterized. These decisions (for example, inspecting a scree plot and deciding the number of factors to extract) while not arbitrary do to some degree involve a certain amount of subjective judgment. In the case of this study two EFAs were conducted for each version of the instrument (the short and long versions) with one of these EFAs being led entirely by the data (i.e. involving decision rules such as the eigenvalue greater than one rule and inspection of a scree plot) and the other being led by the original two-factor conception for the instrument.

Results

Results are initially reported for the descriptive statistics for scores generated by the K-LoC43, and in terms of each item making up the scale.

Descriptive Statistics

Table 1 indicates the means and standard deviations for each item, as well as the value for skew and kurtosis in each case, with the associated standard errors. These were used to calculate the critical ratio for skew and kurtosis for each item, which can be inspected in Table 2. Table 1 includes all 43 items comprising the K-LoC43. It should be noted, in view of what has been explained above in terms of the K-LoC43 being the original K-LoC18 plus 25 new and appended items, that Items 1 through 18 comprise the K-LoC18 and are the same for both versions.

Table 1.

Item Means, Standard Deviations (SD), Skew and Kurtosis for Scores Derived on Items Comprising the K-LoC43 (N=1125)

			Skew		**Kurtosis**	
Test Items	**M**	***SD***	**Statistic**	**SE**	**Statistic**	**SE**
Item 01	2.23	0.896	0.16	0.073	-0.835	0.146
Item 02	3.09	0.909	-0.804	0.073	-0.145	0.146
Item 03	2.4	0.906	0.023	0.073	-0.81	0.146
Item 04	2.94	0.817	-0.417	0.073	-0.357	0.146
Item 05	2.3	0.929	0.24	0.073	-0.797	0.146
Item 06	2.24	0.947	0.261	0.073	-0.872	0.146
Item 07	2.7	0.876	-0.327	0.073	-0.54	0.146
Item 08	2.34	0.965	0.22	0.073	-0.909	0.146
Item 09	2.42	1.029	0.112	0.073	-1.127	0.146
Item 10	3.34	0.79	-1.176	0.073	1.024	0.146
Item 11	2.52	0.945	-0.095	0.073	-0.897	0.146
Item 12	2.59	0.833	0.024	0.073	-0.601	0.146

Item 13	3.05	0.872	-0.703	0.073	-0.15	0.146
Item 14	2.17	0.937	0.403	0.073	-0.72	0.146
Item 15	2.58	0.856	-0.088	0.073	-0.623	0.146
Item 16	2.28	0.804	0.434	0.073	-0.164	0.146
Item 17	2.5	1.037	-0.018	0.073	-1.161	0.146
Item 18	1.94	0.838	0.695	0.073	-0.009	0.146
Item 19	2.97	0.826	-0.566	0.073	-0.112	0.146
Item 20	2.53	0.927	-0.085	0.073	-0.843	0.146
Item 21	2.84	0.963	-0.445	0.073	-0.752	0.146
Item 22	2.92	0.881	-0.533	0.073	-0.374	0.146
Item 23	2.73	0.929	-0.208	0.073	-0.843	0.146
Item 24	2.96	0.853	-0.593	0.073	-0.168	0.146
Item 25	2.8	0.909	-0.239	0.073	-0.815	0.146
Item 26	1.85	0.834	0.85	0.073	0.257	0.146
Item 27	2.26	0.898	0.252	0.073	-0.704	0.146
Item 28	2.46	0.832	-0.035	0.073	-0.571	0.146
Item 29	2.59	0.938	-0.108	0.073	-0.872	0.146
Item 30	2.7	0.782	-0.06	0.073	-0.477	0.146
Item 31	2.32	0.931	0.13	0.073	-0.88	0.146
Item 32	2.99	0.859	-0.567	0.073	-0.305	0.146
Item 33	2.19	0.953	0.377	0.073	-0.791	0.146
Item 34	2.86	0.893	-0.444	0.073	-0.526	0.146
Item 35	2.79	0.858	-0.31	0.073	-0.534	0.146
Item 36	2.01	0.861	0.618	0.073	-0.194	0.146
Item 37	2.57	0.871	-0.12	0.073	-0.657	0.146
Item 38	3.42	0.79	-1.383	0.073	1.444	0.146
Item 39	3.3	0.814	-1.112	0.073	0.769	0.146
Item 40	2.33	0.77	0.36	0.073	-0.148	0.146
Item 41	2.75	0.963	-0.263	0.073	-0.913	0.146

Item 42	2.98	0.895	-0.615	0.073	-0.345	0.146
Item 43	2.81	0.834	-0.346	0.073	-0.402	0.146

As noted above, Table 2 indicates the results for skew and kurtosis for each item. The asterisks indicate whether the absolute value of the critical ratio fails to meet the more relaxed (3.0, two asterisks) or the stricter (2.0, one asterisk) criterion; and thus the sign for the critical ratio in the case of each item is not important.

Table 2.
Calculated Values for Critical Ratio for Skew and Kurtosis

	Calculated Values			**Calculated Values**	
Test Items	**Skewness**	**Kurtosis**	**Test Items**	**Skewness**	**Kurtosis**
Item 01	*2.19	**-5.73	**Item 23**	*-2.843	**-5.785
Item 02	**-10.995	-1.025	**Item 24**	**-8.113	-1.184
Item 03	0.309	**-5.561	**Item 25**	**-3.264	**-5.591
Item 04	**-5.706	*-2.47	**Item 26**	**11.624	1.712
Item 05	**3.283	**-5.471	**Item 27**	**3.449	**-4.835
Item 06	**3.569	**-5.982	**Item 28**	-0.477	**-3.926
Item 07	**-4.465	**-3.718	**Item 29**	-1.474	**-5.978
Item 08	**3.009	**-6.233	**Item 30**	-0.825	**-3.286
Item 09	1.527	**-7.717	**Item 31**	1.78	**-6.036
Item 10	**-16.077	**6.944	**Item 32**	**-7.757	*-2.113
Item 11	-1.299	**-6.147	**Item 33**	**5.157	**-5.427
Item 12	0.329	**-4.132	**Item 34**	**-6.069	**-3.62
Item 13	**-9.612	-1.06	**Item 35**	**-4.235	**-3.679
Item 14	**5.516	**-4.942	**Item 36**	**8.456	-1.362
Item 15	-1.202	**-4.282	**Item 37**	-1.643	**-4.516
Item 16	**5.935	-1.156	**Item 38**	**-18.918	**9.807
Item 17	-0.245	**-7.948	**Item 39**	**-15.212	**5.202
Item 18	**9.506	-0.099	**Item 40**	**4.917	-1.042
Item 19	**-7.746	-0.803	**Item 41**	-3.6	**-6.263

Item 20	-1.167	**-5.782	**Item 42**	**-8.408	*-2.39
Item 21	**-6.08	**-5.164	**Item 43**	**-4.727	*-2.774
Item 22	**-7.293	*-2.587			

Note. *Test item is skewed at a threshold of 2.0. ** Test item is skewed at a threshold of 3.0.

As can be seen in Table 2, with respect to skew, 13 items (30.2%) fell below the 2.0 threshold, with 2 items (4.6%) meeting the 3.0 threshold and the remaining 28 (65.1%) items failing to meet the 3.0 threshold. The calculated values for kurtosis are 9 items (20.9%) meeting the 2.0 threshold, 5 items (11.6%) meeting the 3.0 threshold and the remaining 29 items (67.4%) failing to meet the 3.0 threshold. It should be noted, that this scale is very coarse for this kind of analysis, having only four points of discrimination, and the results should be critically understood in those terms.

Exploratory Factor Analysis Results

The data set was analyzed using EFA. It was hoped that the results of EFA could help in the interpretation and analysis of the real latent structure of the instrument, in both its short and long forms, given that the results of the CFAs for the a priori models were not satisfactory (Rupp, 2016a) and that a qualitative focus group investigation (Rupp, 2016b) of the instrument revealed numerous potential issues such as scale length and item redundancy. Also, the results from an EFA might possibly provide information useful in any future revision of the instrument. For each version of the instrument, two EFAs were conducted. The first EFA was based on an evaluation of the original un-rotated extractions to determine the number of factors to extract, taking into consideration the eigenvalue greater than one rule (Kaiser, 1960) and the scree plots (Cattell, 1966). The second was based on a two-factor extraction with the possible presence of two factors being informed by the original conception for the instrument; i.e. two factors with one being Internal and one being External. The purpose of this second EFA was to scrutinize for items which may not be expressing the latent construct they were originally purported to measure.

Exploratory Factor Analysis of K-LoC18

Exploratory factor analysis was conducted on scores generated by the K-LoC18 instrument. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was .803, above the recommended value of .6, and Bartlett's test of sphericity was significant (χ^2 [153] = 3403.38, p < .000). Thus, the data, under the KMO index and Bartlett test, showed evidence of being approximately multivariate normal and therefore indicated the matrix as acceptable for factor analysis.

In order to decide the number of factors to extract in EFA, it is necessary to conduct an initial unrotated extraction of factors (using PCA, or Principal Components Analysis) from the matrix, followed by application of rules of convention to decide how many of the derived factors should be extracted in a second-run EFA where the number of factors is stipulated. The conventions for making the determination of number of factors to extract typically include the eigenvalue greater than one rule, as well as making a visual judgement based on the change in the slope on a scree plot; and this change in slope actually corresponds to the drop in eigenvalues and amount of variance accounted for as each subsequent factor is extracted. The interpretability of obtained factors is also a criterion for fixing the number of factors to extract in a second-run EFA, although in this study, this criterion was subordinated to the mathematical criteria (scree plot and eigenvalue greater than one rule). See Figure 1 for the scree plot and Table 3 for the eigenvalues.

Table 3.

Total Variance Explained and Initial Eigenvalues for K-LoC18

Component	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	3.475	19.304	19.304
2	2.398	13.324	32.628
3	1.345	7.470	40.098
4	1.092	6.064	46.162
5	0.973	5.404	51.565
6	0.927	5.148	56.714
7	0.876	4.868	61.582
8	0.854	4.746	66.328
9	0.785	4.363	70.692
10	0.727	4.040	74.731
11	0.700	3.888	78.619
12	0.647	3.595	82.214
13	0.631	3.505	85.719
14	0.568	3.154	88.873
15	0.545	3.030	91.903
16	0.522	2.901	94.804
17	0.487	2.704	97.508
18	0.449	2.492	100

Extraction Method: Principal Component Analysis.

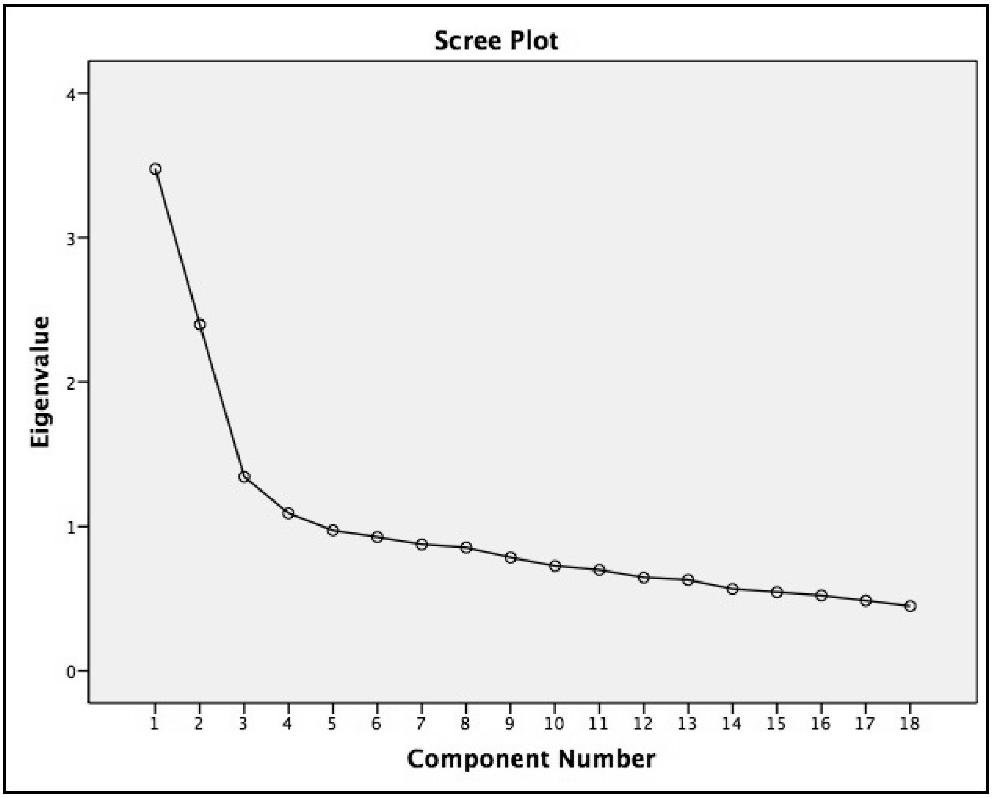

Figure 1. This figure shows the scree plot of the K-LoC18 (unrotated extraction). The vertical axis represents Eigenvalues and the horizontal axis represents the component number for a particular Eigenvalue (indicated with small circles in the graph).

According to the eigenvalue greater than one rule, the rotated extraction should be conducted with four factors, which would explain a total of 46.16% of the variance.

As can be seen in Figure 1, the slope begins to change drastically after the fourth component, suggesting a four-factor extraction. This is in concordance with the eigenvalue greater than one rule and thus a four-factor extraction was conducted.

Table 4 shows the principal component analysis from the initial unrotated extraction. These results for the initial extraction are reported here, but they should not be the subject for the final interpretation. Component 1 loads external LoC (E-LoC) items negatively and includes positively loaded items which were internal LoC (I-LoC) items by conception. Component 2 tends to load E-LoC items more strongly than I-LoC items, and components 3 and 4 appear to be more randomly loaded with external and internal items; furthermore, they only account for approximately 13.5% of the total variance explained. However, it should be noted that it is inevitable in an EFA that subsequent factors account for less and less of the variance in the matrix, because a factor which accounts for most of the variance in the matrix is extracted, and then the next factor is extracted from the residual variance and so on. As mentioned above, and to reiterate, these results for the initial extraction are reported here, but they should not be the basis for interpretation. The rotated solution (oblique or correlated rotation) which follows, and the associated pattern matrix, should be the subject of interpretation.

Table 4.

Component Matrix for K-LoC18

	Component			
	1	2	3	4
Item 01	-0.267	0.439	-0.042	-0.099
Item 02	0.664	0.207	0.219	-0.246
Item 03	0.51	0.253	-0.388	-0.349
Item 04	0.36	0.205	0.282	0.176
Item 05	-0.192	0.522	-0.053	-0.245
Item 06	-0.364	0.555	-0.068	-0.227
Item 07	-0.126	0.439	0.38	-0.219
Item 08	-0.503	0.22	0.24	0.194
Item 09	-0.295	0.466	0.159	0.072
Item 10	0.513	0.132	0.566	0.004
Item 11	0.607	0.311	-0.264	0.124
Item 12	0.36	0.303	-0.114	0.633
Item 13	0.675	0.201	0.193	0.058
Item 14	0.401	0.35	-0.358	0.329
Item 15	-0.149	0.652	0.108	0.109
Item 16	-0.376	0.392	-0.07	0.069
Item 17	0.473	0.181	-0.337	-0.325
Item 18	-0.532	0.187	-0.364	0.127

Extraction Method: Principal Component Analysis.
4 components extracted.

Based on both the slope change of the scree plot and the eigenvalue greater than one rule, a four-factor extraction was conducted on the K-LoC18 data set using Direct Oblimin rotation; i.e. a form of rotation which allows factors to correlate, on the presumption that factors in the human sciences are never, in principle, truly orthogonal (see Kline, 1994).

Table 5 shows the four-factor rotated extraction results with the loading threshold set at greater than .4.

Table 5.

Pattern Matrix for Component Factor Extraction on K-LoC18

	Component			
	1	2	3	4
Item 03 (I)	0.759			
Item 17 (I)	0.681			
Item 08 (E)	-0.471			
Item 06 (E)		0.685		
Item 15 (E)		0.623		
Item 05 (E)		0.600		
Item 07 (E)		0.541		
Item 09 (E)		0.523		
Item 01 (E)		0.514		
Item 16 (E)		0.462		
Item 10 (I)			0.784	
Item 02 (I)			0.603	
Item 18 (E)			-0.575	
Item 13 (I)			0.561	
Item 04 (I)			0.458	
Item 12 (I)				0.788
Item 14 (I)				0.640
Item 11 (I)	0.432			0.480

Extraction Method: Principal Component Analysis.
Rotation Method: Oblimin with Kaiser Normalization.
Rotation converged in 11 iterations.
(E) denotes E-LoC items and (I) denotes I-LoC items according to original conception for the instrument.

It can be seen from Table 5 that Factors 1 and 4 are associated with internal LoC (I), with Item 08 (an external LoC item, E) being negatively associated, and Item 11 (I) loading on both components 1 and 4. Factor 2 comprises items which are E-LoC, and Factor 3 comprises internal LoC items, with the exception of Item 18 which is an E-LoC item negatively associated with the component.

Turning to the two-factor solution which is informed by the original conception for the instrument, i.e. that there would be two factors (one internal and one external), a rotated (oblique rotation via Direct Oblimin) was run with the number of factors to extract stipulated as two. The results can be inspected in the associated pattern matrix in Table 6.

Table 6.

Pattern Matrix on 2 Component Extraction K-LoC18

	Component	
	1	2
Item 13 (I)	0.689	
Item 11 (I)	0.684	
Item 02 (I)	0.681	
Item 03 (I)	0.571	
Item 14 (I)	0.525	
Item 10 (I)	0.513	
Item 17 (I)	0.502	
Item 12 (I)	0.465	
Item 04 (I)	0.416	
Item 06 (E)		0.659
Item 15 (E)		0.658
Item 05 (E)		0.557
Item 09 (E)		0.549
Item 16 (E)		0.515
Item 01 (E)		0.513
Item07 (E)		0.453
Item 08 (E)		0.411
Item 18 (E)		

Extraction Method: Principal Component Analysis.
Rotation Method: Oblimin with Kaiser Normalization.
Rotation converged in 5 iterations.
(E) denotes E-LoC items and (I) denotes I-LoC items according to original conception for the instrument.

As can be seen in Table 6, all of the items apart from Item 18 (an E-LoC item), cleanly loaded (with the threshold for loading set at > .4) on their respective factors as originally hypothesized by the author and his conception for the instrument (Kambara, 1987). Factor 1 comprised all the I-LoC items and Factor 2 had loadings exclusively from E-LoC items. Item 18 failed to load on either factor.

Exploratory Factor Analysis of K-LoC43

EFA was also conducted on the K-LoC43 instrument. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was .860, above the recommended value of .6, and Bartlett's test of sphericity was significant (χ^2 (903) = 9994.52, p < .000). Thus, the data, under the KMO index and Bartlett test, showed evidence of being approximately multivariate normal and therefore indicated the matrix as acceptable for factor analysis. As with the K-LoC18 EFA detailed in the previous section, an initial unrotated extraction of factors from the matrix was conducted using PCA, followed by application of the rules of convention for deciding the number of derived factors to be extracted in the second-run EFA. Table 7 shows the initial eigenvalues.

Table 7.

Total Variance Explained and Initial Eigenvalues for K-LoC43

Component	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	5.876	13.664	13.664
2	3.827	8.9	22.565
3	2.298	5.345	27.909
4	1.937	4.505	32.415
5	1.265	2.942	35.356
6	1.224	2.846	38.202
7	1.168	2.717	40.919
8	1.15	2.674	43.594
9	1.132	2.632	46.226
10	1.078	2.506	48.732
11	1.019	2.369	51.101
12	0.99	2.303	53.404
13	0.964	2.241	55.646
14	0.946	2.2	57.845
15	0.916	2.13	59.976
16	0.886	2.06	62.036
17	0.844	1.963	63.999
18	0.821	1.909	65.908
19	0.783	1.82	67.728
20	0.772	1.796	69.524
21	0.75	1.745	71.269
22	0.747	1.738	73.007
23	0.723	1.681	74.688
24	0.698	1.624	76.312
25	0.684	1.591	77.904
26	0.671	1.561	79.465
27	0.649	1.510	80.974
28	0.642	1.493	82.468
29	0.616	1.433	83.901
30	0.596	1.386	85.287
31	0.589	1.370	86.657
32	0.580	1.348	88.005
33	0.563	1.309	89.314

34	0.522	1.214	90.529
35	0.516	1.200	91.729
36	0.500	1.164	92.893
37	0.478	1.111	94.003
38	0.464	1.079	95.082
39	0.457	1.062	96.144
40	0.448	1.042	97.186
41	0.416	0.966	98.152
42	0.406	0.943	99.095
43	0.389	0.905	100

Extraction Method: Principal Component Analysis.

As shown in Table 7, according to the eigenvalue greater than one rule, the rotated extraction should be conducted with 11 factors, which would explain 51.10% of the variance. Given that the original construct model should consist of only two factors, such a large number might indicate a problem. Zwick & Velicer (1986) have also indicated that the eigenvalue greater than one rule can have a tendency to severely overestimate the number of factors to extract, suggesting the scree test also be taken into consideration. An attempt at running an EFA, with 11 factors stipulated for extraction, did in fact fail to converge in 25 iterations. The next step was to examine the scree plot for a marked change in slope which would, correspondingly, reflect a marked drop-off in the variance explained by subsequent factors, and therefore a diminishing return for the further compromising of overall model parsimony by extracting additional factors. Figure 2 shows the scree plot for the unrotated K-LoC43 extraction.

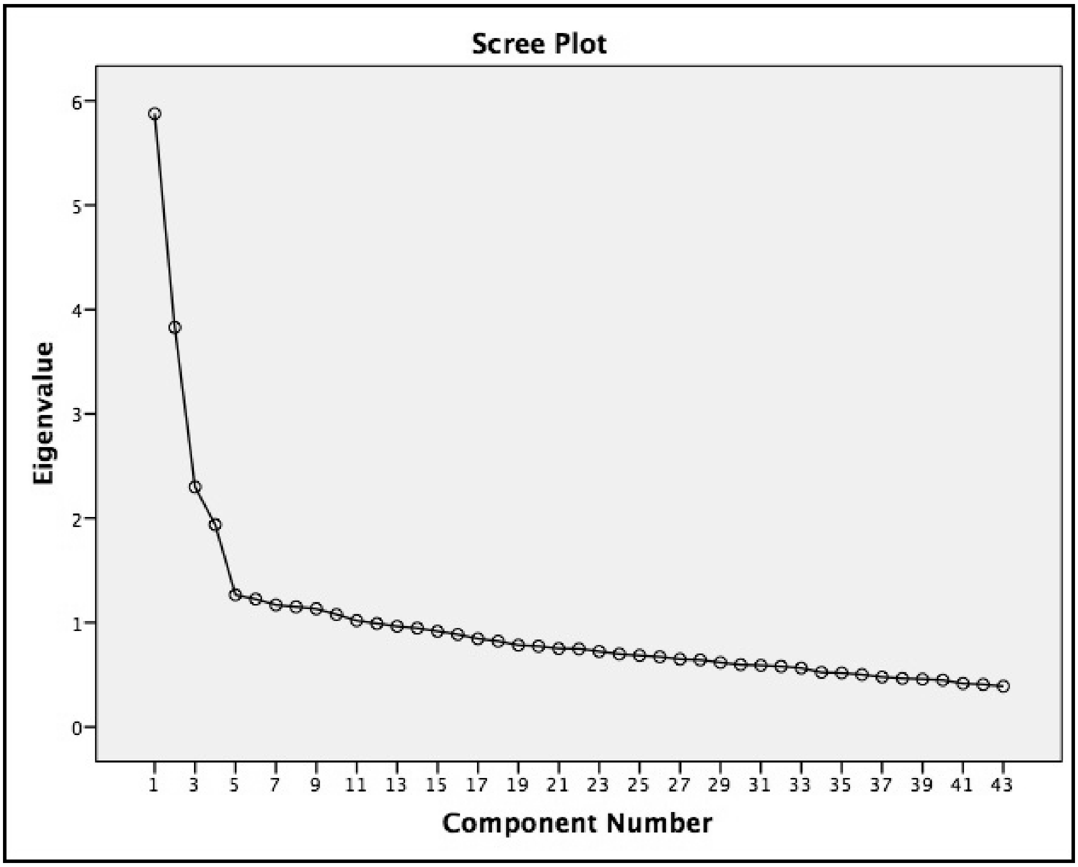

Figure 2. This figure shows the scree plot for the K-LoC43. The vertical axis represents Eigenvalues and the horizontal axis represents the component number for a particular Eigenvalue (indicated with small circles in the graph).

As can be seen in Figure 2, the slope changes drastically after the fifth component, suggesting a five-factor extraction and thus a five-factor extraction was conducted. The component matrix from the initial unrotated extraction is shown in Table 8. As with comments made above with respect to the K-LoC18 and the component matrix for the unrotated extraction, this is not the solution which should be interpreted; the pattern matrix for the rotated solution below (see Table 9) is the solution which should be interpreted. However, it is reported here for the purposes of comprehensiveness and a full account of results. Component 1 comprises items which are internal LoC according to the original conception for the instrument, whereas Component 2 comprises items which are external LoC according to the original conception for the instrument. As would be expected, the loadings become progressively weaker and less distinct with respect to the original conception for the instrument, when comparing the item loadings from Component 4 to Component 11. This is to be expected because these additional components explain progressively less variance and therefore provide little analytical leverage.

Table 8.

Component Matrix for K-LoC43 Components 1 to 6

	Component					
	1	2	3	4	5	6
Item 01	-0.148	0.424	0.029	-0.063	-0.04	0.403
Item 02	0.667	0.065	0.015	0.127	-0.103	0.051
Item 03	0.407	0.082	0.372	0.369	-0.199	0.022
Item 04	0.373	0.044	0.166	-0.303	-0.309	-0.104
Item 05	-0.106	0.417	0.114	-0.039	-0.345	0.233
Item 06	-0.219	0.546	0.036	0.042	-0.133	0.132
Item 07	0.016	0.452	-0.145	-0.11	-0.083	-0.214
Item 08	-0.368	0.337	-0.123	-0.212	0.166	0.031
Item 09	-0.15	0.477	-0.041	-0.211	-0.028	0.261
Item 10	0.564	0.051	-0.211	-0.153	-0.274	-0.097
Item 11	0.497	0.072	0.455	0.205	-0.056	0.041
Item 12	0.337	0.128	0.363	-0.146	0.041	-0.114
Item 13	0.693	0.061	0.051	0.078	0.06	-0.017
Item 14	0.311	0.146	0.527	-0.004	-0.079	0.057
Item 15	-0.027	0.564	0.121	-0.198	-0.131	0.044
Item 16	-0.266	0.466	0.035	0.009	0.092	-0.072
Item 17	0.454	0.066	0.258	0.33	0.128	0.097
Item 18	-0.498	0.301	0.148	0.069	0.128	-0.018
Item 19	0.599	0.186	-0.001	0.054	0.13	-0.082
Item 20	-0.004	0.451	0.012	0.167	0.154	-0.412
Item 21	0.606	0.065	0.157	0.159	0.080	0.125
Item 22	0.122	0.474	-0.200	-0.187	0.091	-0.087
Item 23	0.357	0.184	0.001	-0.103	0.421	0.200
Item 24	0.547	0.159	-0.080	-0.120	0.380	0.043
Item 25	0.131	0.269	-0.103	-0.156	0.067	0.260
Item 26	-0.356	0.389	0.356	0.194	0.008	-0.073
Item 27	-0.228	0.457	0.117	0.035	0.184	-0.390
Item 28	-0.087	0.34	-0.296	0.579	0.018	0.074
Item 29	0.227	0.178	-0.03	0.149	0.377	-0.006
Item 30	0.273	0.097	0.351	-0.472	-0.016	-0.084
Item 31	-0.098	0.316	0.034	0.026	-0.305	-0.244
Item 32	0.156	0.289	-0.45	-0.039	-0.019	0.070
Item 33	-0.37	0.363	0.043	0.029	0.043	-0.052
Item 34	0.471	0.196	-0.127	0.116	0.125	-0.083
Item 35	0.349	0.134	0.052	0.049	-0.036	-0.206
Item 36	-0.350	0.338	0.307	0.158	-0.027	-0.076
Item 37	-0.050	0.303	-0.343	0.54	-0.124	0.178

Item 38	0.605	0.164	-0.359	-0.161	0.009	-0.015
Item 39	0.53	0.181	-0.37	-0.141	-0.127	-0.187
Item 40	0.008	0.185	0.301	-0.346	0.168	0.326
Item 41	-0.024	0.282	-0.126	-0.249	-0.061	-0.105
Item 42	0.542	0.154	-0.018	0.116	-0.172	0.083
Item 43	0.162	0.218	-0.26	0.03	-0.184	0.157

Table 8.
(continued)
Components 7 to 11

	7	8	9	10	11
Item 01	-0.011	-0.197	0.041	0.13	0.049
Item 02	-0.072	0.144	0.15	0.202	-0.065
Item 03	-0.032	-0.031	-0.165	0.102	0.082
Item 04	0.246	-0.342	0.252	0.17	0.264
Item 05	-0.227	-0.172	0.061	0.112	-0.132
Item 06	-0.226	-0.216	-0.106	-0.104	-0.203
Item 07	-0.311	-0.069	-0.046	0.053	0.256
Item 08	0.156	-0.004	0.154	0.236	-0.052
Item 09	-0.042	0.043	-0.104	-0.082	-0.113
Item 10	0.031	0.156	0.241	0.114	0.003
Item 11	-0.096	0.245	0.055	0.046	-0.113
Item 12	0.034	0.13	0.102	-0.323	0.086
Item 13	-0.062	0.162	0.163	-0.037	-0.176
Item 14	0.053	0.198	0.053	-0.125	0.021
Item 15	-0.247	-0.038	0.072	-0.184	-0.154
Item 16	0.015	0.057	0.056	0.121	0
Item 17	0.016	-0.272	-0.212	-0.052	0.16
Item 18	0.177	-0.22	-0.047	-0.083	0.054
Item 19	0.023	-0.112	-0.102	-0.071	0.045
Item 20	-0.209	0.029	-0.113	0.247	0.159
Item 21	-0.041	0.075	0.002	0.259	-0.085
Item 22	-0.162	-0.089	0.081	-0.103	-0.107
Item 23	-0.217	0.008	0.159	0.174	0.172
Item 24	-0.067	-0.122	-0.236	-0.029	0.102
Item 25	0.191	0.188	-0.207	-0.059	0.199
Item 26	0.140	-0.013	-0.04	-0.117	-0.148
Item 27	-0.097	0.193	0.037	0.170	0.093
Item 28	0.099	-0.063	0.162	-0.045	0.188
Item 29	0.364	-0.085	0.316	-0.166	-0.100
Item 30	0.274	-0.338	0.048	-0.012	0.205

Item 31	0.054	0.22	-0.024	-0.38	0.277
Item 32	0.044	0.143	0.288	-0.276	-0.025
Item 33	0.205	0.161	-0.164	0.094	-0.124
Item 34	0.043	-0.082	-0.212	-0.311	-0.182
Item 35	0.269	-0.234	-0.075	0.14	-0.483
Item 36	0.199	0.087	0.287	0.154	-0.068
Item 37	0.157	-0.029	0.154	0.004	0.192
Item 38	0.001	-0.016	0.072	0.087	-0.023
Item 39	0.077	-0.034	-0.068	-0.053	-0.151
Item 40	0.077	0.314	0.013	-0.029	0.074
Item 41	0.242	0.204	-0.34	0.174	-0.025
Item 42	0.042	-0.044	-0.184	-0.046	0.128
Item 43	0.317	0.220	-0.311	0.184	0.042

Extraction Method: Principal Component Analysis.
11 components extracted.

Based on the scree plot slope analysis, a five-factor extraction was conducted on the K-LoC43 data set using Direct Oblimin rotation. Table 9 shows the five-factor extraction results with loading threshold set at greater than .4.

Table 9.

Pattern Matrix for 5 Component Extraction on K-LoC43

	Component				
	1	2	3	4	5
Item 03 (I)	0.718				
Item 11 (I)	0.703				
Item 17 (I)	0.581				
Item 14 (I)	0.54				
Item 21 (I)	0.539				
Item 02 (I)	0.522				
Item 13 (I)	0.494				
Item 42 (I)	0.450				
Item 19 (I)					
Item 08 (E)					
Item 12 (I)					
Item 35 (I)					
Item 06 (E)		0.593			
Item 15 (E)		0.566			
Item 26 (E)		0.56			
Item 16 (E)		0.514			
Item 27 (E)		0.505			

Item 36 (E)		0.503			
Item 09 (E)		0.477			
Item 05 (E)		0.476			
Item 18 (E)		0.463			
Item 33 (E)		0.46			
Item 01 (E)		0.447			
Item 20 (E)		0.403			
Item 07 (E)					
Item 31 (E)					
Item 39 (I)			-0.655		
Item 38 (I)			-0.633		
Item 10 (I)			-0.582		
Item 32 (E)			-0.492		
Item 43 (E)					
Item 22 (E)					
Item 41 (E)					
Item 25 (E)					
Item 28 (E)				0.677	
Item 37 (E)				0.667	
Item 30 (I)				-0.61	
Item 40 (I)				-0.447	
Item 04 (I)					
Item 24 (I)					0.528
Item 23 (I)					0.519
Item 29 (I)					0.456
Item 34 (I)					

Extraction Method: Principal Component Analysis.
(E) denotes E-LoC items and (I) denotes I-LoC items according to original conception for the instrument.
Rotation Method: Oblimin with Kaiser Normalization.
Rotation converged in 22 iterations.

It is apparent from Table 9 that only 31 of the 43 items loaded onto these five factors. The items which loaded onto Factor 1 were all I-LoC items, with Factor 2 having E-LoC items. Factor 3 comprised negatively-loaded I-LoC items (with one exception) while Factor 4 comprised a combination of E-LoC items and negatively-loaded I-LoC items. Factor 5 comprised only I-LoC items.

As with the K-LoC18 EFA, a two-factor solution was also obtained which was informed by the original conception for the instrument; i.e. that there would be two factors (one internal and one external). A rotated (oblique rotation via Direct Oblimin) was run with the number of factors to extract stipulated, therefore, as two. The results can be inspected in the associated pattern matrix in Table 10.

Table 10.

Pattern Matrix for 2 Component Extraction on K-LoC43

	Component	
	1	2
Item 13 (I)	0.685	
Item 02 (I)	0.661	
Item 19 (I)	0.627	
Item 38 (I)	0.627	
Item 21 (I)	0.601	
Item 24 (I)	0.570	
Item 42 (I)	0.563	
Item 39 (I)	0.559	
Item 10 (I)	0.558	
Item 34 (I)	0.506	
Item 11 (I)	0.499	
Item 17 (I)	0.456	
Item 03 (I)	0.414	
Item 23 (I)		
Item 35 (I)		
Item 04 (I)		
Item 12 (I)		
Item 14 (I)		
Item 30 (I)		
Item 29 (I)		
Item 43 (E)		
Item 06 (E)		0.585
Item 15 (E)		0.549
Item 16 (E)		0.522
Item 27 (E)		0.502
Item 09 (E)		0.500
Item 26 (E)		0.473
Item 33 (E)		0.452
Item 01 (E)		0.449
Item 20 (E)		0.434
Item 07 (E)		0.430
Item 05 (E)		0.430
Item 18 (E)	-0.4	0.427
Item 08 (E)		0.426
Item 36 (E)		0.422
Item 22 (E)		0.421
Item 28 (E)		

Item 31 (E)
Item 37 (E)
Item 41 (E)
Item 32 (E)
Item 25 (E)
Item 40 (I)

Extraction Method: Principal Component Analysis.
Rotation Method: Oblimin with Kaiser Normalization.
Rotation converged in 5 iterations.
(E) denotes E-LoC items and (I) denotes I-LoC items according to original conception for the instrument.

As with the K-LoC18, Table 10 shows that nearly all of the items which loaded (with the threshold set at > .4), did so cleanly on their respective factors according to the original conception as hypothesized by Kambara (1987). Factor 1 comprised items which were, by conception, intended to measure the I-LoC construct, and Factor 2 had loadings nearly completely from the original E-LoC construct, with the exception of Item18 (E-LoC) which loaded on both factors. It is interesting to note that a majority of items which did not load in the 5-factor extraction, also failed to load in the 2-factor extraction, possibly indicating weaker items that might be eliminated in future modifications of the K-LoC. Also, it is noteworthy that Item18 had failed to load on either factor (in the K-LoC18) or instead loaded on both factors (in the K-LoC43), possibly indicating a problematic item.

Discussion

The purpose of the EFA analysis which was post hoc, and which as a method is subordinate to the direct testing offered by CFA, was to further explore the dimensionality of a data set which, in a series of CFAs (Rupp, 2016a), had failed to indicate plausible conformity to models consistent with the original conception for the instrument (Kambara, 1982, 1987) and models inherited from other post hoc analyses in the literature (Hosaka, 2007). The EFA analysis was also considered to have potential for interesting comparisons with separate results from qualitative focus group analysis (Rupp, 2016b).

In the case of the K-LoC18 EFA, the unrotated extraction suggested that according both to the eigenvalue greater than one rule (see Table 3), and the scree plot analysis (see Figure 1), a four-factor rotated solution should be conducted, which is twice the number of factors associated with the measurement model presented in the original conception for the instrument. The four-factor solution ended up with only about half of the items being grouped together in factors according to their originally conceived I-LoC and E-LoC groupings. The second factor comprised only E-LoC items while the first, third and fourth factors comprised predominantly I-LoC items, but with some extraneous E-LoC items to upset the coherence of each of these factors. Thus, another rotated EFA was conducted with only two factors being extracted in order to investigate whether the items would load according to the conception of the original instrument when forced onto only two factors; i.e. with all the I-LoC items loading on one factor and all the E-LoC items loading on another factor. The two-factor extraction showed that all but one item, Item 18 (an E-LoC item), did in fact load in this coherent fashion; subject of course to the executional contingency that the loading threshold was set at .40. This is a positive result for the instrument from one point of view, and had a more powerful CFA not been conducted (Rupp, 2016a) unlike previous studies where EFA is the only analysis brought to bear on the data, this positive result could be taken as the definitive one. However, in light of the fact that the CFA showed poor model fit, and the fact that these first two components explain only 32% of the variance, such positive views must be tempered by the analytical point that approximately 68% of the variance remains unexplained. This variance is either error or the result of other constructs/latents which remain unspecified and outside the original theoretical model informing its purported structure and the scoring regime for practitioners (Kambara, 1982).

Turning to the K-LoC43, the results are relatively less satisfactory than those for the K-LoC18; and the term relatively is used here because this is not to suggest that the results for the K-LoC are actually satisfactory. Upon examining the eigenvalue greater than one rule for the K-LoC43 (see Table 7), it was suggested that an 11-factor solution be conducted, which was a startlingly high number of factors given the original conception of the K-LoC43 as having only two factors. Nevertheless, a rotated extraction of 11 factors was attempted, but then abandoned after a solution failed to converge within 25 iterations. It may have been possible to reset SPSS to allow for further iterations, but the failure to converge resonated with the surprise at the rather extraordinary number of factors suggested by the eigenvalue greater than one rule, and thus the scree plot (Figure 2) was examined closely. The scree plot suggested a five-factor solution; one more than for the K-LoC18, and a more reasonable expectation given that the addition of so many new items might introduce further systematic lines of variance into the matrix. Thus, a five-factor solution was extracted. The loadings showed some coherence with respect to the item groupings for the first two factors, much as was the case with the K-LoC18; however, the remaining three factors had more random loadings, as well as having 12 items which failed to load altogether (representing nearly a quarter of the instrument). This high proportion of non-loading items was not the case with the four-factor extraction conducted on the K-LoC18, for which every item loaded, although one item (Item 11) loaded weakly on two factors in the four-factor extraction of the K-LoC18.

The next step with respect to the K-LoC43, and similar to the second step for the K-LoC18, was to force a two-factor extraction on the K-LoC43 consistent with the original conception for the instrument. In the two-factor pattern matrix (see Table 10), 13 I-LoC items loaded on Factor 1 and 15 E-LoC items loaded on Factor 2, leaving 15 items, or 35% of the items outside the model. This again indicates problems with the instrument in its long form. The EFAs conducted for both the short and long form suggest that increasing the number of items from 18 to 43 does not actually represent a step forward, but rather a reduction in the clarity of the scale. This is an unfortunate situation given that the K-LoC18 is rarely if ever used in the Japanese research context, whereas the K-LoC43 is quite frequently used. It may be that researchers are erroneously laboring under the false premise that more items are better, and that the revised instrument inevitably improves upon its predecessor. Such problems have occurred with other such long LoC instruments such as the Reid-Ware Three-Factor Internal-External Scale, as detailed in the literature review, wherein the longer, 45-item version, was also found to produce better results when shortened. The lengthening of an instrument becomes even less beneficial when it is done by adding further items which have significant overlap in content, as the extra items are not broadening the operational expression of the construct being measured, but rather are simply introducing operational redundancy. This resonates quite strongly with the findings from the earlier qualitative focus-group study (Rupp, 2016b) conducted by the current author; and in fact, it corroborates these findings. One of the features of the data derived in this qualitative study was that participants regularly alluded to item redundancy. They tended to feel that item content was being repeated and that this was a negative aspect of the 43-item version of the instrument which formed the subject matter of the focus-group interviews. In this respect, the EFA conducted, and reported here, would lend empirical support to the position that many of the items in the K-LoC43 do not need to be included in the instrument and serve only to reduce the effectiveness of the instrument.

Conclusion

While the enterprise to look at LoC as a proxy to measure learner autonomy is still worth pursuing, it is clear that this endeavor cannot be pursued with this instrument in its current form and that this instrument requires further revision. It should be noted that CFA should become a part of this process. EFA will be useful as an exploratory tool in the formulation of a revised instrument, but whatever revision emerges will have to be submitted to an a priori test to ensure that the structure suggested by any exploratory procedure is generalizable to the population and not sample specific. Finally, in the absence of such a revision, the 18-item version of the instrument is relatively better than the 43-item version of the instrument and should be adopted; and there is now an evidence-based rationale for this recommendation which is found in the results of this study.

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Appendix: Author's Translation of K-LoC43

(Kambara, 1987)

Item (E = External; I = Internal)

1 E 何でも成り行きまかせが1番だ。
[It is best to just go with the flow.]

2 I 努力すれば立派な人間になれる。
[I can be a great success if I work hard.]

3 I 一生懸命に話せば誰にでも自分を分かってもらえる。
[Anyone will be able to understand me if I try my best to communicate with them.]

4 I 自分の人生を自分自身で決定している。
[I decide my own life.]

5 E 自分の人生は運命で決められている。
[My life is decided by fate.]

6 E 自分が幸福なるか不幸になるかは偶然によって決められる。
[My happiness and sadness are determined by chance.]

7 E 自分の身に起こることは自分の置かれている環境によって決定されている。
[What happens depends on the situation.]

8 E どんなに努力しても友人の本当の気持ちを理解することはできない。
[My friends can't understand me no matter how hard I try.]

9 E　人生はギャンブルのようだ。
[Life is a gamble.]

10 I　将来自分が何になるかを考えることは,役に立つ(意味がある)。
[It is useful (meaningful) to think about what I want to be in the future.

11 I　努力すればどんなことでも自分の力でできる。
[If I try hard, I can do anything on my own.]

12 I　たいていの場合,自分自身で決断した方が良い結果を生む。
[Usually, things turn out better if I make my own decisions.]

13 I　幸福になるか不幸になるかは,自分の努力次第だ。
[My happiness or sadness is determined by my own efforts.]

14 I　自分の一生を思い通りに生きることができる。
[I will be able to live my entire life as I plan to.]

15 E　自分の将来は運やチャンスによって決まる。
[My future is determined by fate or chance.]

16 E　自分の身に起こることは自分の力ではどうすることもできない。
[What happens does not depend on my efforts.]

17 I　努力すれば誰とでも友人になることができる。
[I can be friends with anyone if I try.]

18 E　あなたの努力と成功とはあまり関係がない。
[Your efforts and success are not related to each other.]

19 I　自分の行動に注意していればいずれは人から信頼される。
[If I am careful about my actions, people will trust me.]

20 E　親友ができるかどうかは,クラスやクラブの雰囲気による。
[My ability to make good friends depends on the class or club's atmosphere.]

21 I　努力すれば希望の職につくことができる。
[If I try hard, I will be able to get the job I want.]

22 E　理想的な相手と結婚できるかどうかは巡り合わせだ。
[Marrying an ideal partner depends on fate or luck.]

23 I　予習復習をしておけばテストで良い成績を取るのは簡単だ。
[It is easy to get a good score on tests if I prepare for lessons and review afterwards.]

24 I　自分の努力次第で異性の友人を作ることができる。
[I can make friends with the opposite sex if I try.]

25 E　自分でも気付かずに衝動的に行動することがよくある。
[I often do impulsive things without being aware of it.]

26 E　希望する大学に進学できるかどうかは能力よりも偶然に左右される。
[Getting into my first-choice university depends more on luck than ability.]

27 E　友人とのつきあいが長く続くかどうかは周りの状況による。
[Being able to maintain long friendships depends on the external situation.]

28 E あなたが何か行動する時,自分の希望というよりも人が言うからそうすることがよくある。
[When you take actions, it is more often the case that others have suggested them rather than you acting upon your own desires.]

29 I 学校の授業が面白くないとすれば自分がその教科の勉強をあまりしないからだ。
[If a class in school is boring, it is because you are not interested in that subject.]

30 I 自分のすることはいつも自分で決める。
[I always decide what I'm going to do.]

31 E テストの結果はあなたの場合,体調や偶然の出来事でしばしば左右される。
[In your case, when it comes to test results, they are often influenced by your physical condition or other random events.]

32 E 自分で決めたように行動することは難しい。
[It is hard for me to do things as I have planned.]

33 E 頭の良し悪しは変えることはできない。
[We can't change how smart or stupid we are.]

34 I 友情が続くかどうかはあなたの努力次第である。
[Maintaining friendships depends on your effort.]

35 I 必要があればいつでも自分の欲求を抑えることができる。
[If necessary, I can suppress my desires at any time.]

36 E 異性の友人ができるかは運によるので自分の行動をどうすべきか考えても仕方ない。
[There is no use in thinking about how to make friends with members of the opposite sex as such things are determined by fate/depend upon luck.]

37 E 自分の行動はまわりの状況によく流される。
[My actions tend to end up going along with the flow of circumstances.]

38 I 前もって計画的に試験勉強をすれば結果はずっと良くなる。
[The results are far better when I prepare for exams in advance.]

39 I 友人と仲良くやるために自分の行動を考えることは重要である。
[It is important to think about my actions in order to have good relationships with my friends.]

40 I 友人と意見が違っても,自分の行動を優先することが多い。
[Even if my friends have different ideas, I place a priority on my own actions.]

41 E 成績はつける先生によって変わる。
[My grades depend on the teacher.]

42 I 友人に親切にしていればいつかは友人に助けてもらえる。
[If I am kind to my friends, someday they will help me.]

43 E やりたくないと思っていても行動していることがよくある。
[I often find myself doing things that I don't like to do.]

鎌原氏のローカス・オヴ・コントロール（統制の所在）尺度で日本の高校生から収集したデータに対するの探索的因子分析

ラップ　マイケル　ジェームズ

本論文は、鎌原（1982, 1987）が開発した尺度「統制の所在: LoC」(The Kambara Locus of Control Scale (K-LoCS)（18項目版および43項目（拡大）版）によって1125名の高校生からデータを収集し、探索的因子分析（EFA）により解析したものである。本研究は英語教育などにおける学習者の自律（learner autonomy: LA）と密接にかかわり LA 研究において、先行研究に成功したものはほとんどないことを踏まえ、この分野の進展に貢献することを目指している。本論文の EFA の目標は、以前に行ったフォーカス・グループ法（Rupp, 2016b）と確認的因子分析（CFA）の研究によって修正の必要性が明らかになった K-LoCS（Rupp, 2016a）を、EFA の分析によってさらに K-LoCS への修正提案を探索することである。結果から本尺度の項目を減少することによって尺度が改善できる余地があることがあることが明らかになった。