# Reduction of Items of Questionnaires on Language Learning Employing VIF

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**Reference Data:**

Fukuda, T. (2025). *Reduction of items of questionnaires on language learning employing VIF*. In B. Lacy, M. Swanson, & P. Lege (Eds.), Moving JALT Into the Future: Opportunity, Diversity, and Excellence. JALT. https://doi.org/10.37546/JALTPCP2024-39

The current study investigates the use of the Variance Inflation Factor (VIF) to help reduce questionnaire items on school belonging and L2 motivation in second language acquisition (SLA) research. Previously, other approaches, such as use of Cronbach's alpha for consistency, factor analysis, and Rasch analysis, were used to validate these questionnaires but they were left lengthy. Drawing on data from 540 Japanese university students, the study employed VIF to identify redundant items, adopting a strict threshold of 2.5 to ensure rigorous reduction. As a result, the school belonging questionnaire was reduced from 23 to 20 items, and the L2 motivation questionnaire decreased from 33 to 26 items. Despite the reduction, construct validity was maintained through careful analysis of overlapping concepts. The findings of this study demonstrate the effectiveness of VIF in streamlining questionnaires without compromising validity. This study introduces VIF as a novel method for item reduction in applied linguistics, offering a practical tool to enhance questionnaire design in future research.

本研究は、第二言語習得（SLA）研究における、学校帰属意識と第二言語習得動機の質問紙項目を削減する目的で、分散拡大要因（VIF）の利用を検討する。従来の手法を用いて妥当性を検証すると質問紙は冗長のように思われた。本研究では日本の大学生540名のデータを用い、余分な項目を特定するためにVIFを用いたが、厳密な削減を確実に行うために、2.5という厳密な閾値を採った。その結果、学校帰属意識の質問紙は23項目から20項目に、第二言語習得動機の質問紙は33項目から26項目に削減された。このように減少はしたものの、重複する概念を注意深く分析することにより、構成概念妥当性は維持された。本研究で得られた知見は、妥当性を損なうことなく質問紙を合理化するVIFの有効性を示している。本研究は応用言語学における項目削減の新しい手法としてVIFを紹介し、今後の研究において質問紙の作成を強化するための実用的なツールを提供するものである。

Asking questions is a fundamental way of gathering data in research, and questionnaires are one of the most common tools in language learning research (Dörnyei & Dewaele, 2023). Numerous studies on language learning have employed questionnaires for data collection. For example, Fukuda (2020) conducted a study investigating two psychological constructs: school belonging and L2 motivation. Initially, the questionnaires contained 59 items: 22 in the school belonging questionnaire, and 37 items in the L2 motivation questionnaire. After a validation process, the number was reduced to 56 items: 23 in the school belonging questionnaire and 33 in the L2 motivation questionnaire. This reduction was achieved using three common methods: Internal consistency with Cronbach's alpha, exploratory factor analysis (EFA), and Rasch analysis, which are considered traditional approaches for questionnaire validation (Staffini et al., 2022).

Upon revisiting the questionnaires in 2023, however, the total of 56 items appeared excessively lengthy, particularly the L2 motivation with 33 items. This highlighted the need for an additional step to streamline the questionnaires beyond the three methods already employed in Fukuda (2020). A review of the literature in applied linguistics and second language acquisition (SLA) revealed no method for reducing questionnaire items beyond the traditional approaches. In other fields such as business management and health sciences, however, the Variance Inflation Factor (VIF) is often employed as a method of item reduction (e.g., Staffini et al., 2022). Reference works in applied linguistics such as Dörnyei and Dewaele (2023) and Jeon (2015) mention VIF, but with regard to the multicollinearity diagnostics of variables, not for item reduction. Therefore, this study is likely the first attempt to apply VIF to reduce questionnaire items in language learning research.

## Review of Literature

### The Ideal Number of Question Items

This paper describes a process of reducing the number of questionnaire items when they are deemed excessive. Thus, it was first necessary to determine what constitutes an ideal number of items. According to Sharma (2022), effective questionnaires should take no longer than 30 minutes to complete, which typically corresponds to no more than 30 items. Overly lengthy questionnaires can lead to issues such as low response rates (Iglesias & Torgerson, 2000) and reduced concentration among participants (Sahlqvist et al., 2011). Based on this, the aim was to reduce the number of items to 30 or fewer in a single questionnaire.

It should be noted that the primary purpose of questionnaires is to elicit valid and reliable data (Dörnyei & Dewaele, 2023). Reducing the number of items must not compromise the construct validity of the questionnaire (O'Leary-Kelly & Vokurka, 1998). Therefore, after employing VIF or other methods of item reduction, the revised questionnaire should be evaluated to ensure that construct validity is maintained.

### Variance Inflation Factor

VIF is defined as the strength of multicollinearity among a set of variables (Allison, 1999), and multicollinearity means "a strong correlation between two or more predictors" (Field, 2023, p. 324). Thus, VIF can identify redundancies in a questionnaire. While internal consistency with alpha assesses how consistent the items are, VIF examines whether an item is excessively similar to other items, thus potentially redundant.

In academic areas other than applied linguistics and second language acquisition, VIF is employed to identify redundant variables, such as questionnaire items. These areas include economics (e.g., Zhang & Wang, 2014), business management (e.g., Gholami et al., 2013) and health care (e.g., Jones et al., 2013). Staffini et al. (2022) summarized the traditional approaches to reducing questionnaire items. They point out that three traditional approaches, Cronbach's alpha, factor analysis, and Item Response Theory, are employed for that purpose. They add that recent studies have employed VIF to address collinearity problems.

No universally accepted threshold seems to exist about the ideal VIF score as previous studies employed a wide range of VIF thresholds. The threshold employed in previous studies ranges from 10 (Marquardt, 1970; Mason & Perreault, 1991; Vittenghoff et al., 2012; Zhang & Wang, 2014), 5 (Hair et al., 2019; James et al., 2021), 3.3 (Cheah et al., 2018; Diamantopoulos & Siguaw, 2006) to as low as 2.5 (Allison, 1999; Jeon, 2015; Johnston et al., 2018). Given these variations, this study tentatively adopts the strictest threshold, 2.5, to ensure the most rigorous reduction of questionnaire items employed in previous studies.

One of the studies that employed VIF for this purpose was Staffini et al. (2022). In this study, the researchers reduced the number of items in a questionnaire about *representative lifestyle*. The construct of *representative lifestyle* consists of three components: *daily lifestyle*, *weekly lifestyle*, and *monthly lifestyle*. Initially, the questionnaire had 51 items in total, and there were 21 items in the *daily lifestyle* component, 26 items in the *weekly lifestyle* component, and 4 items in the *monthly lifestyle* component. After the VIF process, the total number of items was reduced to 26. There were 3 in the *daily lifestyle* component, 21 in the *weekly lifestyle* component, and 2 in the *monthly lifestyle* component. The number of items in the revised questionnaire, 26, is lower than the ideal number of question items suggested by Sharma (2022).

### Research Questions

Following the discussions above, the current study seeks to answer the following research questions

RQ1. Can the number of items in the school belonging and the L2 motivation questionnaires be reduced by employing VIF?

RQ2. Are the revised questionnaires valid in terms of construct validity?

## Methods

The data in the current study were collected from 540 first-year students in four private universities in eastern Japan in 2018 for a large study (Fukuda, 2020). The questionnaires in this study measured two psychological constructs: school belonging and L2 motivation. School belonging consists of three components: *pride in membership*, *support by others*, and *comfort in membership*. L2 motivation consists of five components: *effort*, *enjoyment*, *integrativeness*, *instrumentality*, and *ideal L2 self*.

The current study examined the 23 items in the school belonging questionnaire and 33 items in the L2 motivation questionnaire. Each of the components in the school belonging questionnaire had 7 or 8 items: 8 items in *pride in membership*, 7 items in *support by others*, and 8 items in *comfort in membership*. Each of the components in the L2 motivation questionnaire had 6 or 7 items: 7 items in *effort*, 7 items in *enjoyment*, 6 items

in *integrativeness*, 6 items in *instrumentality*, and 7 items in *ideal L2 self*. The Likert-scale questions in the questionnaires were structured as 4-point responses that indicated the extent to which each participant agreed with the statement: 1 = *No*; 2 = *Not very much*; 3 = *Yes, a little*; 4 = *Yes*.

In the current study, SPSS Version 29 (IBM, 2023) was used to obtain the Variance Inflation Factor (VIF). SPSS provides VIF values when the researcher selects **Analyze > Regression > Linear**, and then checks **Collinearity Diagnostics** under the **Statistics** option.

## Results

In the current study, the VIF score of each item in the two questionnaires was obtained for the purpose of identifying too much overlapping of items. Table 1 shows the VIF score of each item in the school belonging questionnaire. The VIF score over the threshold, which is in red in Table 2, indicates that the item might overlap too much with other items. In other words, three items (SB07, SB15, and SB18) were found to be possibly redundant.

In addition to the VIF score of each item in the whole school belonging questionnaire, the VIF in the component were further examined. To be more specific, the eight items in the *pride in membership* component (SB01–07 and SB23), the seven items in the *support by others* component (SB08– SB14), and the eight items in the *comfort in membership* component (SB15– SB22) were examined separately. However, all the VIF scores were smaller than in the whole questionnaire, because VIF, which indicates the extent of multicollinearity, naturally becomes large when the number of items in the group of variables is large, and vice versa. Therefore, no additional items were identified as potential candidates for deletion within the three components.

Table 1
*School belonging questionnaire Items with VIF scores*

| Number | Item | VIF |
|---|---|---|
| SB01 | I wanted to get into this university. | 1.96 |
| SB02 | I feel proud of belonging to this university. | 2.41 |
| SB03 | I dreamed of studying at this university before coming here. | 2.04 |
| SB04 | I admire my teachers at this university. | 1.68 |
| SB05 | My classes are intellectually satisfying. | 1.66 |
| SB06 | I respect students at this university. | 1.92 |
| SB07 | I am happy to be a student at this university. | 2.75 |
| SB08 | Other students in this university take my opinions seriously. | 1.75 |
| SB09 | Teachers at this university are interested in me. | 2.03 |
| SB10 | Other students here like me the way I am. | 2.10 |
| SB11 | There's at least one teacher or other adult in this university I can talk to if I have a problem. | 1.80 |
| SB12 | People at this university are friendly to me. | 1.97 |
| SB13 | I am treated with as much respect as other students. | 1.83 |
| SB14 | I know how to find help at this university if necessary. | 1.83 |
| SB15 | I feel like a real part of this university. | 2.63 |
| SB16 | I can really be myself at this university. | 2.25 |
| SB17 | I feel I can voice my opinions freely here. | 2.10 |
| SB18 | I feel I belong here. | 3.07 |
| SB19 | I am included in lots of activities at this university. | 1.38 |
| SB20 | When I have a question, I feel comfortable asking other students about it. | 1.58 |
| SB21 | When I have a question, I feel comfortable asking my teachers about it. | 1.69 |
| SB22 | I feel comfortable when I am asked to help others at this university. | 1.39 |
| SB23 | I am satisfied with the level of this university. | 1.65 |

Following the results in the VIF analysis, those potentially redundant items were examined in terms of the contents contrasting with other items. As a result, it was found that all the three items in red directly state the target construct, school belonging. In other words, the concepts represented by the three items are targeted by other items or

combinations of other items. Thus, it was decided that the construct validity would be secured even if the items were omitted. The revised school belonging questionnaire has 20 items.

Table 2 shows the VIF score of each item in the L2 motivation questionnaire. The VIF score over 2.5, which is in red in Table 2, indicates that the item might overlap too much with other items. In other words, the 12 items in red in Table 2 (MOT07, MOT15, MOT18, MOT22, MOT30, MOT31, MOT32, MOT33, MOT34, MOT35, MOT36, and MOT37) were found to be potentially redundant and thus might be omitted. As in the school belonging questionnaire, further analyses were conducted in the five components of the L2 motivation questionnaire: the *effort* component (MOT01– MOT09), the *enjoyment* component (MOT10– MOT16), the *integrativeness* component (MOT17–MOT22), the *instrumentality* component (MOT24– MOT30), and the *ideal L2 self* component (MOT31– MOT37) . However, all the VIFs became smaller in this analysis; thus, no further items were found to be potentially redundant.

Table 2

*L2 Motivation Questionnaire Items with VIF scores*

| Number | Item | VIF |
|---|---|---|
| MOT01 | Even if English was not a compulsory subject, I would choose to study it. | 2.28 |
| MOT02 | I regularly use English in class with my classmates. | 1.64 |
| MOT03 | Even if the teacher is not close to me, or cannot hear me, I still speak English with my classmates in class. | 1.58 |
| MOT04 | I make efforts to speak English outside of class. | 2.46 |
| MOT07 | I try to use English in daily life. | 3.01 |
| MOT08 | I try to learn English from other sources such as the Internet. | 1.98 |
| MOT09 | I am prepared to expend a lot of effort in learning English. | 2.35 |
| MOT10 | I enjoy learning English in class. | 1.90 |
| MOT11 | I enjoy learning English out of class. | 2.35 |
| MOT12 | I wish we had more English classes. | 1.96 |
| MOT13 | I prefer studying English to other subjects. | 2.21 |
| MOT14 | When I'm on my way to English class, I feel relaxed. | 1.89 |
| MOT15 | I will continue studying English after finishing English courses. | 2.51 |
| MOT16 | For me, English is easier than other subjects. | 1.60 |
| MOT17 | I would like to make foreign friends who speak English. | 2.38 |
| MOT18 | I would like to go abroad to study English. | 2.63 |
| MOT19 | I am interested in learning about other cultures by learning English. | 2.43 |
| MOT20 | I would like to live in a foreign country for a few years. | 2.37 |
| MOT21 | I would like to speak English when I travel in foreign countries. | 1.82 |
| MOT22 | I would like to know more about English speaking countries. | 2.63 |
| MOT24 | English proficiency is an essential skill for my future. | 2.31 |
| MOT26 | Studying English is important for me because I'll need it for my future career. | 2.42 |
| MOT27 | Studying English is important for me because I can work anywhere in the world with English. | 2.14 |
| MOT28 | English will be useful for my future studies. | 2.18 |
| MOT29 | English is important in order to attain a high social respect. | 1.35 |
| MOT30 | I need to study English to do what I want to do. | 2.51 |
| MOT31 | I would like to use English in my daily life in the future. | 2.89 |
| MOT32 | I would like to get a job using my English abilities in the future. | 5.06 |
| MOT33 | I would like to belong to a group of friends who use English in the future. | 3.53 |
| MOT34 | I would like to belong to a group of professionals who use English in the future. | 2.67 |
| MOT35 | I would like to choose a career that requires English proficiency in the future. | 4.93 |
| MOT36 | I would like to work in a foreign country using English in the future. | 3.74 |
| MOT37 | I would like to speak English with international friends and colleagues in the future. | 3.26 |

Following the results in the VIF analysis, these 12 potentially redundant items were examined in terms of the contents contrasting with other items. It was decided that the first five items in red in Table 2, namely MOT07, MOT15, MOT18, MOT22, and MOT30, would be omitted for the same reason as in the school belonging questionnaire. They represent the concept targeted by other items, too. For example, MOT07 "I try to use English in daily life" is an overarching concept of other detailed ones represented by MOT08 "I try to learn English from other sources such as the Internet" and MOT09 "I am prepared to expend a lot of effort in learning English". Thus, the construct validity would be secured even if the items were omitted.

Next, the other seven items in red in Table 2 that were judged to be potential candidates for deletion, namely MOT31, MOT32, MOT33, MOT34, MOT35, MOT36, and MOT37, were examined. These seven items are conceptualized as forming a component of *ideal L2 self*. Considering the significance of *ideal L2 self* as a component of L2 motivation, it was deemed inappropriate to omit all the items in this component while maintaining construct validity.

To further investigate the redundancy of these seven items in the *ideal L2 self* component of the L2 motivation questionnaire, the items were examined in the component with VIF again. Table 3 presents the VIF scores for these seven items in the *ideal L2 self* component. As previously discussed, VIF scores tend to decrease when the number of variables in a set of analysis is reduced, and this was evident in the current analysis. Among the items, MOT32 and MOT35, which are in red in Table 3, exhibited relatively high VIF values of 4.37 and 4.57 respectively. In contrast, the other items had considerably lower VIF values, with one item, MOT34, even showing a VIF of 2.48, which was below the initial threshold of 2.5.

When considering the group of five other items than MOT32 and MOT35, it appears that they collectively address the factor of *ideal L2 self*, which is the future self-images associated with using English in both private and professional contexts. Thus, to determine redundancy within this group, the threshold of 3.3, the second lowest VIF threshold cited in the previous literature (Cheah et al., 2018; Diamantopoulos & Siguaw, 2006), was applied exclusively to the *ideal L2 self* component.

Table 3

*Ideal L2 Self Items in the L2 Motivation Questionnaire with VIF scores*

| Number | Item | VIF |
|---|---|---|
| MOT31 | I would like to use English in my daily life in the future. | 2.61 |
| MOT32 | I would like to get a job using my English abilities in the future. | 4.37 |
| MOT33 | I would like to belong to a group of friends who use English in the future. | 2.99 |
| MOT34 | I would like to belong to a group of professionals who use English in the future. | 2.48 |
| MOT35 | I would like to choose a career that requires English proficiency in the future. | 4.57 |
| MOT36 | I would like to work in a foreign country using English in the future. | 3.26 |
| MOT37 | I would like to speak English with international friends and colleagues in the future. | 2.61 |

As a result of the VIF analyses explained above, the number of items in the school belonging questionnaire was reduced from 23 to 20. In the revised questionnaire, the component of *pride in membership* has 7 items, *support by others* has 7 items, and *comfort in membership* has 6 items. The number of items in the L2 motivation questionnaire was reduced from 33 to 26. In the revised questionnaire, the component of *effort* has 6 items, *enjoyment* has 6 items, *integrativeness* has 4 items, *instrumentality* has 5 items, and *ideal L2 self* has 5 items.

## Discussion

Based on the above results, the research questions of the current research can be answered as follows. RQ1 was whether the number of items in the school belonging questionnaire and the L2 motivation questionnaire could be reduced by employing VIF. This question can be answered in the affirmative. Initially, the school belonging questionnaire consisted of 23 items, but it was reduced to 20 after applying the VIF process. Similarly, the L2 motivation questionnaire, originally comprising 33 items, was shortened to 26. As Sharma (2022) suggests, a questionnaire should ideally contain

no more than 30 items, and the revised versions of both questionnaires adhere to this guideline.

RQ2 was whether the revised questionnaires were valid in terms of construct validity. This question can be answered in the affirmative, too. An examination of the revised questionnaires confirmed that they both effectively targeted the constructs of school belonging and L2 motivation. The three components of school belonging and the five components of L2 motivation were each addressed by four to seven items per component. Particular attention was given to the *ideal L2 self* component of L2 motivation, by applying a larger VIF threshold exclusively to this component.

The findings of this study carry three important implications for both research and classroom practice. First, the use of VIF analysis demonstrated a practical method for improving questionnaire efficiency by identifying and eliminating redundant items without compromising construct validity. For researchers in educational psychology as well as classroom practitioners, this means that shorter instruments can be developed to assess constructs such as school belonging and L2 motivation, thereby reducing respondent fatigue and enhancing response quality. Second, the careful retention of items that represent distinct aspects of the core component, such as the *ideal L2 self*, underscores the importance of preserving conceptual richness even when statistical redundancy is detected. This balance between statistical parsimony and theoretical comprehensiveness offers a model for scale refinement that can be replicated across diverse educational settings. Finally, by aligning the number of items with practice guidelines (e.g., Sharma, 2022), the revised instruments become more practical for classroom use, enabling teachers to assess student attitudes and needs more regularly and efficiently. The shortened questionnaires can facilitate data-informed interventions that foster stronger belonging and motivation, both of which are critical for academic engagement and success.

## Conclusion

The current research successfully reduced the number of questionnaire items targeting two psychological constructs: school belonging and L2 motivation. This likely represents the first attempt in applied linguistics to employ VIF for item reduction. The number of items of the school belonging questionnaire was reduced from 23 to 20, and the number of items of the L2 motivation questionnaire was reduced from 33 to 26. The resulting revised questionnaires can be utilized for future research with less burden on participants, thereby enhancing data reliability.

One limitation to note is the use of a different threshold for the *ideal L2 self* component of the L2 motivation questionnaire. While a threshold of 2.5 was applied to the school belonging questionnaire and four of the five components of the L2 motivation questionnaire, a higher threshold of 3.3 was used for the *ideal L2 self* component. Therefore, future studies should reexamine the items in the two questionnaires using both conventional analysis methods and VIF analyses again to ensure consistency and validity.

## Bio Data

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