

Research Article

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Motivation and growth in kanji proficiency: a longitudinal study using latent growth curve modeling



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Abstract: Despite the well acknowledged importance of motivation in second language (L2) learning, longitudinal research regarding the effects of motivation on growth in L2 proficiency remains limited. Furthermore, limited investigation has been done on how motivation and L2 proficiency interactively develop and affect each other. Thus, this study examined the impact of motivation on growth in kanji proficiency and the dual developmental trajectories of motivation and kanji proficiency using the self-determination theory. Learners of Japanese with Chinese as their First language (L1) responded to a questionnaire and took kanji tests three times in one academic semester ($n = 192$). The results of the univariate latent growth curve (LGC) modeling identified intrinsic motivation and introjected regulation as positive and negative predictors, respectively, of kanji proficiency growth, suggesting the importance of enjoyment and the detrimental nature of introjected regulation in kanji learning by L1 Chinese learners. The results of multivariate LGC modeling demonstrated a lack of reciprocal developmental association between kanji proficiency and intrinsic motivation. Moreover, perceived competence rather than actual growth in kanji proficiency influenced the enhancement of intrinsic motivation, indicating the importance of subjective interpretations of L2 development in promoting motivation.

Keywords: latent growth curve modeling; motivation; perceived competence; self-determination theory; vocabulary learning

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1 Introduction

Kanji, the Chinese characters used in the Japanese writing system, resemble *hanzi*, the characters of the Chinese writing system. Although kanji have evolved and diverged from hanzi to some extent, Japanese learners who speak Chinese as their first language (L1) enjoy a great advantage in acquiring kanji because of the similarities between the two writing systems. As many kanji share core structures in forms and meanings with hanzi, L1 Chinese learners of Japanese can readily recognize and learn many aspects of the form of kanji (Akutsu 1991) and connect their meaning and form (Shimizu 1993). However, they can transfer only a limited amount of their L1 hanzi knowledge to infer and understand the oral reading of kanji, which is often considered the most difficult part of kanji learning for Japanese students with a background in hanzi (Shimizu 1993). As the oral reading of kanji is a significant issue for L1 Chinese learners of Japanese, this study focused on how learners' motivation affects growth in oral reading proficiency of kanji (hereafter, kanji proficiency). Furthermore, as the self-determination theory (SDT; Ryan and Deci 2017) offers a robust framework to capture a comprehensive picture of motivational mechanism, this study aimed to examine the interplay between longitudinal growth in kanji proficiency and kanji learning motivation of L1 Chinese learners of Japanese as a second language (JSL) through SDT, using latent growth curve (LGC) modeling.

1.1 Self-determination theory and L2 learning

SDT (Ryan and Deci 2017) is among the most influential motivational theories in psychology and has been widely employed in second language (L2) learning (Al-Hoorie et al. 2022). In the SDT framework, motivation is classified into three types—intrinsic, extrinsic, and amotivation—according to the extent to which an individual's behavior regulation is self-determined (Ryan and Deci 2017). Intrinsic motivation refers to motivation to perform an activity for the enjoyment derived from that activity and is the most self-determined type of motivation seeking congruence with one's core self. Amotivation refers to the absence of motivation to act. Extrinsic motivation refers to motivation regulated by external factors and is classified into four types (external, introjected, identified, and integrated regulation), the first three of which are frequently employed in L2 motivation studies (e.g., McEown et al. 2014; Noels 2001). The least self-determined form of extrinsic motivation is external regulation, where an individual's behavior is controlled by factors outside the self, such as rewards and punishments. Introjected regulation is more self-determined than external regulation and is related to maintaining or increasing

self-worth. Identified regulation is the most self-determined among these three types of extrinsic motivation, and concerns a person's goals and values.

As self-determination is a key concept in the theory (Ryan and Deci 2017), the more self-determined types of motivation—intrinsic motivation and identified regulation—tend to yield adaptive effects on L2 outcomes. For example, intrinsic motivation and/or identified regulation were positively associated with English vocabulary size (Alamer 2022; Tanaka 2017), kanji proficiency (Tanaka 2013), listening and reading proficiency (Leeming and Harris 2022), teacher assessment of L2 outcomes (Oga-Baldwin et al. 2017), and course-related grades (Noels et al. 2001; Shaikholeslami and Khayyer 2006; Tanaka 2022; Wang 2008).

In contrast, amotivation has detrimental effects on L2 outcomes, including listening proficiency (Leeming and Harris 2022; Vandergrift 2005), reading proficiency (Kondo-Brown 2006; Leeming and Harris 2022), kanji knowledge (Kondo-Brown 2006), and course-related grades (Shaikholeslami and Khayyer 2006). Moreover, introjected regulation has a debilitating function in certain conditions and has been negatively associated with L2 achievements, such as kanji proficiency (Tanaka 2013), course grades (Shaikholeslami and Khayyer 2006), and listening and reading proficiency (Leeming and Harris 2022). External regulation occasionally has positive effects; however, it does not emerge as a significant predictor of L2 outcomes in many cases (e.g., Leeming and Harris 2022; McEown et al. 2014; Noels et al. 2001).

Thus far, there has been only one piece of extant research to investigate kanji proficiency among L1 Chinese JSL learners using the SDT framework. Tanaka (2013) investigated the cross-sectional relationships between the five SDT types of kanji learning motivation and kanji proficiency using a questionnaire and a kanji test. The results of the multiple regression analysis demonstrated small ($R^2 = 0.16$) but significant effects of the five SDT factors of kanji learning motivation on kanji proficiency, and identified intrinsic motivation ($\beta = 0.37$) and introjected regulation ($\beta = -0.23$) as positive and negative predictors of kanji proficiency, respectively. However, the study did not clarify how motivation varies according to different levels of kanji proficiency, from beginner to advanced learners. Moreover, the findings of the cross-sectional study did not reveal how motivation affects change in L2 proficiency. L2 learning fundamentally concerns the development of L2 proficiency. A longitudinal design, which demands repeated measurements of kanji proficiency at multiple points in time, is necessary to clarify the impact of motivation on growth in kanji proficiency.

1.2 Mastery goals

In addition to SDT motivation, the present study explored the impact of mastery goal orientation (hereafter, mastery goals) on growth in kanji proficiency. Mastery goals

are one of the two key constructs of goal orientation theory and are also labeled “learning goals” or “task involvement goals” (Dörnyei and Ushioda 2021). Mastery goals are recognized to be a highly beneficial learning trait (Dörnyei and Ushioda 2021) since learners with mastery goals aspire to acquire knowledge and endeavor to improve for their own sake. As mastery-oriented learners believe that efforts lead to success, they view errors as learning opportunities and tend to choose challenging tasks (Dweck and Leggett 1988). Although research in L2 learning is limited, mastery goals have been positively associated with constructive responses to failure and intentions to continue learning the L2 (Lou and Noels 2016, 2017), language learning strategies, motivational intensity, oral L2 performance (Woodrow 2006), L2 achievements (Tercanlioglu 2004), positive learning strategies, course grades, and motivation variables including intrinsic motivation (Bonney et al. 2008). In addition, the positive association between mastery goals and intrinsic motivation has often been demonstrated in fields other than L2 learning (Rawsthorne and Elliot 1999), partly as some common attributes are shared between them, such as learning for its own sake (Bonney et al. 2008). However, while the positive effects of intrinsic motivation on L2 achievement are evident (Noels et al. 2001; Shaikholeslami and Khayyer 2006; Tanaka 2013, 2017, 2022; Wang 2008), the effects of mastery goals on L2 learning achievement have been scarcely investigated. Clarifying the role of mastery goals in L2 development in comparison with intrinsic motivation would promote a better understanding of each motivational role.

1.3 Dual developmental trajectories of motivation and proficiency

Motivation does not remain constant during L2 learning, but “ebbs and flows in complex ways in response to various internal and external influences” (Dörnyei and Ushioda 2021: 5). While traditional research has conceptualized L2 motivation as a static, stable, and trait-like disposition, the current approach theorizes it as a complex, dynamic system involving a variety of factors with evolving perspectives (Dörnyei et al. 2015). As learners are assumed to display both time-varying motivation and certain general motivational tendencies, this study investigates both static and dynamic aspects of motivation.

In general, learners evaluate their learning outcomes and form a causal attribution for the learning process. Successful experiences, such as high achievement, reinforce the commitment to learning when attributed to high competence, while low achievement discourages learning when attributed to learners’ low competence (Dörnyei and Ushioda 2021). Although L2 proficiency and motivation are assumed to affect each other interactively, limited research has been conducted to

investigate the reciprocal developmental trajectories of motivation and growth in L2 proficiency.

As mentioned, the relationship between motivation and L2 development is complex and involves many factors. Indeed, motivation accounted for a mere 16% of the variance in kanji proficiency in the previously introduced cross-sectional study (Tanaka 2013). In a similar vein, as various factors intricately affect motivation, proficiency would explain a limited amount of variance in motivation. However, clarifying part of the whole by investigating the mutual developmental relationship between L2 proficiency and motivation may be the first step toward unveiling a more comprehensive system of kanji learning.

1.4 Perceived competence

As high achievement energizes motivation for further learning when ascribed to high competence (Dörnyei and Ushioda 2021), learners' interpretations of L2 development appear to be engaged in the development of motivation. As SDT stipulates that the satisfaction of the three basic psychological needs—autonomy, competence, and relatedness—enhances intrinsic motivation, perceived competence is one of the three fundamental factors to promote self-determined motivation (Ryan and Deci 2017). In L2 learning, perceived competence has been positively associated with intrinsic motivation (Agawa and Takeuchi 2016; Carreira 2012; Carreira et al. 2013; Noels et al. 2000, 2001, 2019; Tanaka 2017; Wu 2003). A meta-analysis study in educational settings (Bureau et al. 2022) revealed perceived competence to be the best predictor of both intrinsic motivation and identified regulation of the three basic psychological needs in SDT. Despite the evident adaptive effects of perceived competence on intrinsic motivation, it is unclear how varying perceived competence affects the dynamic changes in intrinsic motivation and kanji proficiency. It also remains unknown whether perceived competence exerts a stronger influence on intrinsic motivation than actual growth in L2 proficiency. Findings on the comparative effects of the two factors would thus contribute to discerning further mechanisms to foster intrinsic motivation in L2 learning.

1.5 Research objective

This study identified three gaps in the available literature. First, despite the evidenced cross-sectional association between motivation and kanji proficiency (Tanaka 2013), it remains unknown how general motivational tendencies differ among learners with varying levels of kanji proficiency. The effects of motivation on

growth in kanji proficiency over time are also unclear. Second, while kanji proficiency and motivation are assumed to develop and affect each other interactively, limited research has been conducted to investigate their reciprocal developmental trajectories. Third, it is unclear how perceived competence affects changes in motivation and growth in kanji proficiency. In addition, whether perceived competence exerts a stronger influence on motivation than actual growth in L2 proficiency remains underexplored. To address these gaps, the present study investigates the following research questions:

- RQ1: To what extent does motivation relate to varying kanji proficiency levels and growth in kanji proficiency?
- RQ2: Do kanji proficiency and intrinsic motivation develop reciprocally?
- RQ3: To what extent does perceived competence affect kanji proficiency and intrinsic motivation?

2 Method

2.1 Participants

The data reported in this study were part of a larger project comprising three main phases using a mixed-method approach. The first two phases employ a quantitative approach, with the first phase (this study) examining the association between motivation and kanji proficiency, and the second phase examining the relationship between motivation and antecedents of the motivation. The third phase used a qualitative approach to explore the detailed contents of kanji learning motivation and the background of the phenomena identified in the quantitative research stage. Due to space limitations, this study focuses on the first phase.

The participants of this study were L1 Chinese JSL learners drawn from three schools in Japan (Schools A, B, and C). The participants at School A (a Japanese-language center) were enrolled in beginner to advanced-level Japanese courses ($n_{\text{final}} = 139$). Most took two 90-min Japanese-language courses from Monday to Friday, which included reading, writing, and speaking. The participants at School B (a Japanese-language school) were enrolled in intermediate- to advanced-level Japanese courses ($n_{\text{final}} = 13$) and took four 50-min Japanese-language courses, including writing and reading, from Monday to Friday. The School C participants ($n_{\text{final}} = 40$) were university students who were required to take several Japanese-language courses, including reading and writing, in addition to the undergraduate courses offered in Japanese at the university.

The tests and questionnaire were administered three times to each participant in this longitudinal study. Although 340 students participated in the study initially at Time 1, many participants withdrew at Time 2 or 3. As this study used the complete data across all three time points for the main analysis, the final sample size stood at 192 after data screening. The 192 participants (74 men and 118 women) were aged between 18 and 40 ($M = 22.96$, $SD = 3.33$). Although they were from various areas, such as mainland China including Inner Mongolia ($n = 131$), Taiwan ($n = 51$), Hong Kong ($n = 9$), and Australia ($n = 1$), all of them reported Chinese as their L1. The duration of their Japanese learning varied between 1 and 97 months, with an average of 2 years and 5 months ($M = 29.57$ months, $SD = 16.30$) at the time of initial data collection.

2.2 Instruments

2.2.1 Growth in kanji proficiency

The participants' growth in kanji proficiency was estimated using three kanji tests (pre-test, mid-test, and post-test). As the proficiency levels varied greatly among the participants, three forms were developed for each test (Forms A, B, and C for low, intermediate, and high-proficiency learners, respectively), resulting in nine forms (three forms \times three tests). Each form consisted of 40, 50, and 50 items in the pre-test, mid-test, and post-test, respectively.

All the items in Forms A and B and most items in Form C were multiple-choice items, adopted from the writing vocabulary section of Levels 1–4 of the previous version of the Japanese-Language Proficiency Test (The Japan Foundation and Japan Educational Exchanges and Services 1991, 1995a, 1995b, 1996a, 1996b, 1997a, 1997b, 1999, 2000a, 2000b, 2001a, 2001b, 2002, 2005, 2006). The following are sample items that appeared in Form A of the pre-test. The participants were asked to choose the appropriate oral reading for each underlined kanji.

弟⁽¹⁾は ばんごはん に おいしい 魚の 料理を 用意⁽²⁾してくれました。

(1) 弟	1 おとうと	2 おとと	3 おとと	4 おとうと
(2) 用意	1 ようい	2 よい	3 よい	4 よんい

Note. The correct answers are 4 and 1 for (1) and (2), respectively.

In addition to the multiple-choice items, Form C, which targeted high-proficiency learners, included several items of writing the oral reading of the underlined kanji. The items were created based on *Kanzen Master-JLPT Level 1-Kanji* (Katakuri Nihongo Kyoshikai 2003). The following is a sample item from Form C of the pre-test. The

participants were asked to write the oral reading of the underlined kanji. No partial scores were awarded.

無条件に科学を信仰する時代はもはや終わりを告げた。

Note. The correct answer is つ.

All nine forms were linked using the Rasch model (Rasch 1980) and test-equating procedures (Linacre 2009a; Wright 1996; Wright and Stone 1979) with Linacre's (2009b) Winsteps computer program (Version 3.69.0). With the equating procedures, the learners' proficiency estimates were directly comparable, regardless of the form (i.e., Form A, B, and C) and the testing time (i.e., pre-test, mid-test, or post-test), as all the estimates of their kanji proficiency were located on a single linear scale of measurement. In the Rasch analysis, two reliability estimates are calibrated for person and item: "reliability," which indicates the reproducibility of measure-order, and "separation," which indicates the number of statistically different performance levels (Linacre 2009a). The sample and items are distinguished into at least three levels, when values are >0.90 and >3.00 for reliability and separation, respectively (Linacre 2009a). However, the general benchmarks for practical use are separation of 2.00 and reliability of 0.80 (Linacre 2009a). When unanchored, the Rasch item (person) reliability was 0.93 (0.86) for the pre-test, 0.93 (0.89) for the mid-test, and 0.92 (0.88) for the post-test, while the Rasch item (person) separation was 3.65 (2.50) for the pre-test, 3.58 (2.83) for the mid-test, and 3.48 (2.75) for the post-test. As reliability and separation were around 0.90 and 3.00, the three tests were adequately reliable.

2.2.2 Motivation and mastery goals

This study used questionnaires to measure motivation variables (five SDT types of motivation, mastery goals, and perceived competence). The questionnaire used a 6-point Likert scale (1 = *Strongly disagree* and 6 = *Strongly agree*) and was administered in Chinese. Appendix A presents the English translation of the questionnaire items. The items measuring the SDT types of motivation were adapted from the questionnaire on kanji learning motivation developed by Tanaka (2013) and consisted of five constructs—*intrinsic motivation*, *identified*, *introjected*, *external regulation*, and *amotivation*. Although each construct comprised six items, one item was identified as misfitting and, thus, was deleted, leaving five items for *introjected regulation*. This study used the data on *intrinsic motivation*, measured three times, at Times 1, 2, and 3 and the rest of the constructs calibrated at Time 1. As mentioned, the data from 192 students were used for the main analysis; however, data available at each time point were used for the preliminary Rasch analysis. The Rasch item (person) reliability was 0.96 (0.78), 0.87 (0.82), and 0.94 (0.89) for *intrinsic motivation*

at Times 1, 2, and 3, respectively, and 0.88 (0.65), 0.95 (0.66), 0.72 (0.69), and 0.98 (0.60) for identified, introjected, external regulation, and amotivation, respectively.

The items measuring mastery goals were developed to measure mastery-potential (learners' aspiration to learn as many kanji as possible) and mastery-improvement (learners' aspiration to constantly improve kanji proficiency), drawing on Hulleman et al. (2010). As one item was misfitting and was deleted, five items were used to measure this construct. The item (person) reliability was 0.93 (0.72). A total of six items were developed to measure perceived competence based on prior studies, including Hiromori (2006). The item (person) reliability was 0.94 (0.67).

While noting that learners' motivational profiles may change because of various internal and external factors, this study operationalized motivational profiles measured at Time 1—the beginning of the study—as trait-like general motivational tendencies, and changes in intrinsic motivation measured through Times 1, 2, and 3 as the dynamic changes of motivation.

2.3 Procedures

In this study, data were obtained from the same participants three times within one academic semester. A single semester was selected as the timeframe of the current longitudinal study, as it is generally self-constrained, wherein students complete certain units of study and receive grades. The kanji tests and the questionnaire were distributed every fifth week (i.e., Week 2 [Time 1], Week 7 [Time 2], and Week 12 [Time 3]) during a regular class. This timing was chosen so that the lag between times could be spaced evenly throughout the semester. As mentioned earlier, this study focused on the data of kanji tests and intrinsic motivation gathered at Times 1, 2, and 3 and the rest of the variables collected at Time 1. While some participants completed the tests and the questionnaire during class time, most participants completed them on their own time and returned them one week later. The participants joined this study voluntarily, without rewards, and consented to the use of their data for the research purpose.

2.4 Data analysis

Data screening was conducted according to Tabachnick and Fidell (2007). As mentioned earlier, the final sample size of 192 was used for the main analysis after the outliers (univariate and multivariate) were deleted. This study employed two types of LGC modeling to address the research questions. As the first research question concerned the unilateral impact of motivation on kanji proficiency,

univariate LGC modeling was employed with motivation variables as predictors of change. Since the second research question examined the extent to which the development of intrinsic motivation and kanji proficiency are interrelated, multivariate associative LGC modeling was used. In addition, perceived competence was included in the multivariate associative LGC model as a predictor of changes in intrinsic motivation and kanji proficiency.

3 Results

3.1 Descriptive statistics

Table 1 and Appendix B present the descriptive statistics and the correlation matrix for the variables used in the models, respectively. At the group level, the participants' initial motivational profile was characterized by very high identified regulation and mastery goals, very low amotivation, slightly high intrinsic motivation and external regulation, and low introjected regulation. In addition, perceived competence was slightly higher than the average. Participants' kanji proficiency and intrinsic motivation both increased from Times 1 to 3.

Table 1: Descriptive statistics for the variables used in the main analysis.

	M	SE	95% CI		SD
			LB	UB	
Pre-test	1.89	0.09	1.71	2.07	1.27
Mid-test	2.08	0.09	1.90	2.26	1.28
Post-test	2.50	0.09	2.32	2.67	1.25
KIM1	0.60	0.14	0.33	0.87	1.90
KIM2	0.78	0.15	0.48	1.08	2.12
KIM3	2.35	0.24	1.87	2.83	3.38
COM1	0.33	0.14	0.05	0.62	1.98
KID1	2.15	0.13	1.89	2.41	1.83
KIJ1	−0.80	0.15	−1.09	−0.50	2.07
KEX1	0.73	0.14	0.45	1.01	1.97
KAM1	−2.70	0.14	−2.97	−2.42	1.91
MAS1	1.66	0.14	1.37	1.94	1.99

n = 192. All the estimates are based on Rasch logits of person ability. KIM1, intrinsic motivation for learning kanji at Time 1; KIM2, intrinsic motivation for learning kanji at Time 2; KIM3, intrinsic motivation for learning kanji at Time 3; COM1, perceived competence at Time 1; KID1, identified regulation for learning kanji at Time 1; KIJ1, introjected regulation for learning kanji at Time 1; KEX1, external regulation for learning kanji at Time 1; KAM1, amotivation for learning kanji at Time 1; MAS1, mastery goals at Time 1; CI, confidence interval; LB, lower bound; UB, upper bound.

3.2 Univariate LGC modeling

3.2.1 Assessment of model fit

A univariate LGC model was built with EQS 6.1 for Windows (Bentler and Wu 2002) to address the first research question regarding the impact of motivation on kanji proficiency. The assumption of multivariate normality was violated with Mardia's normalized estimate (8.772) > 6.00 (See Byrne 2006); the parameters were estimated using the Satorra-Bentler (SB) scales χ^2 corrections for the maximum likelihood method. The model fitted the data very well with the following fit indices: $\chi^2_{SB}(7) = 11.085$, $p = 0.135$, comparative fit index (CFI) = 1.000, and root mean square error of approximation (RMSEA) (90% Confidence Intervals [CI]) = 0.000 (0.000, 0.092). Figure 1 presents the univariate LGC model with the estimated parameters.

3.2.2 Impact of motivation on kanji proficiency

A part of the first research question explored the extent to which general motivational tendencies differ across varying kanji proficiency levels of L1 Chinese JSL learners. Table 2 presents the effects of the six predictors on the intercept (i.e., the initial kanji proficiency levels at Time 1) and the slope (i.e., growth in kanji proficiency over time). The findings indicated that all six paths to the intercept were insignificant, and motivation did not vary across the varying kanji proficiency levels at Time 1. In total, the six predictors accounted for only 2.5% ($R^2 = 0.025$) of variance in the initial kanji proficiency levels.

In addition, the first research question explored the extent to which motivation affects growth in kanji proficiency over time. In all, the six predictors accounted for 13.3% ($R^2 = 0.133$) of variance in kanji proficiency growth (the slope). As R^2 values less than 0.20 are considered small (Plonsky and Ghanbar 2018), the six types of motivation had small yet significant effects on the degree of kanji growth over time. A closer look at individual motivational effects on kanji proficiency growth revealed that two paths from intrinsic motivation ($\beta = 0.349$) and introjected regulation ($\beta = -0.259$) to the slope were significant. A significant positive link was not found between mastery goals and growth in kanji proficiency in this study ($\beta = 0.091$, *n.s.*).

3.3 Longitudinal measurement invariance

As the remaining analysis involved developmental trajectories of intrinsic motivation, longitudinal measurement invariance was examined to ensure temporal equivalence of the construct of intrinsic motivation and its measurement across the

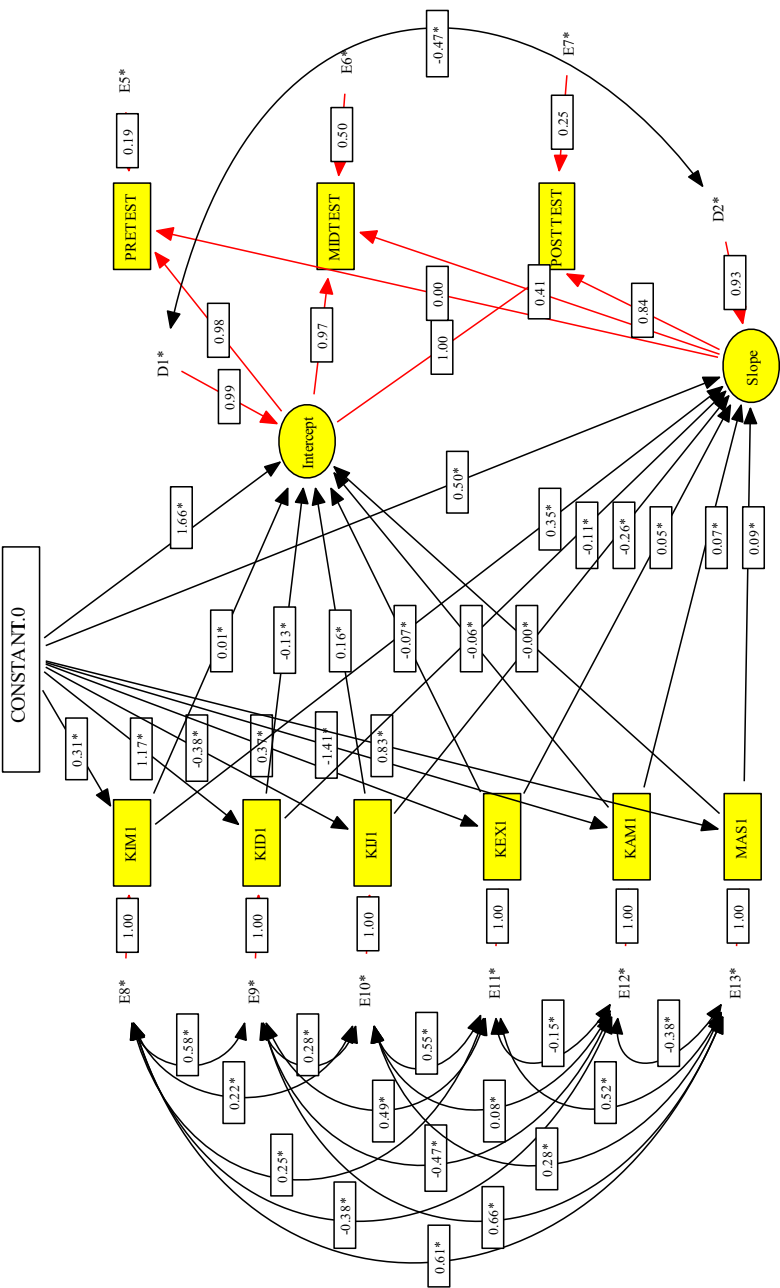


Figure 1: The univariate LGC model with estimated parameters. Note: KIMI, intrinsic motivation for learning kanji at Time 1; KIDI, identified regulation for learning kanji at Time 1; KUI, introjected regulation for learning kanji at Time 1; KEXI, external regulation for learning kanji at Time 1; KAMI, amotivation for learning kanji at Time 1; MAS1, mastery goals for learning kanji at Time 1.

Table 2: Predictor effects for the univariate LGC model.

Predictors	<i>B</i>	<i>SE B</i>	β	<i>t</i>
Intercept				
KIM1	0.009	0.071	0.013	0.121
KID1	−0.087	0.077	−0.127	−1.130
KIJ1	0.095	0.061	0.158	1.567
KEX1	−0.043	0.064	−0.068	−0.668
KAM1	−0.039	0.063	−0.060	−0.627
MAS1	−0.003	0.077	−0.004	−0.035
Slope				
KIM1	0.096	0.033	0.349	2.873
KID1	−0.030	0.032	−0.106	−0.928
KIJ1	−0.065	0.025	−0.259	−2.639
KEX1	0.014	0.030	0.051	0.454
KAM1	0.020	0.023	0.072	0.852
MAS1	0.024	0.026	0.091	0.911

$R^2 = 0.025$ for intercept; $R^2 = 0.133$ for slope. *t*-values greater than [1.96] are significant at $p < 0.05$. KIM1, intrinsic motivation for learning kanji at Time 1; KID1, identified regulation for learning kanji at Time 1; KIJ1, Introjected regulation for learning kanji at Time 1; KEX1, external regulation for learning kanji at Time 1; KAM1, amotivation for learning kanji at Time 1; MAS1, mastery goals for learning kanji at Time 1.

three time points. The analysis was performed on raw data from 192 participants based on Byrne (2006). First, a correlated three-factor model was built to test configural invariance wherein six manifest items per measurement occasion load onto their respective factor (intrinsic motivation at Time 1, 2, or 3). The model achieved a good model fit: $\chi^2_{SB}(126) = 195.845$, $p < 0.01$, CFI = 0.967, and RMSEA (90% CI) = 0.054 (0.038, 0.068); thus, configural invariance held. Second, the measurement invariance was tested by imposing equality constraints on all freely estimated factor loadings and error covariances across times. The model fitted the data well: $\chi^2_{SB}(137) = 208.642$, $p < 0.01$, CFI = 0.966, and RMSEA (90% CI) = 0.052 (0.037, 0.066), and yielded a change in CFI of 0.001 from the configural model. As the Δ CFI value between the models was negligible and did not exceed the practical threshold of Δ CFI ≤ 0.01 (Byrne 2006), measurement invariance was adequately tenable.

3.4 Multivariate associative LGC modeling

3.4.1 Assessment of model fit

A multivariate associative LGC model was built with EQS 6.1 for Windows (Bentler and Wu 2002) to address the second and third research questions. This model

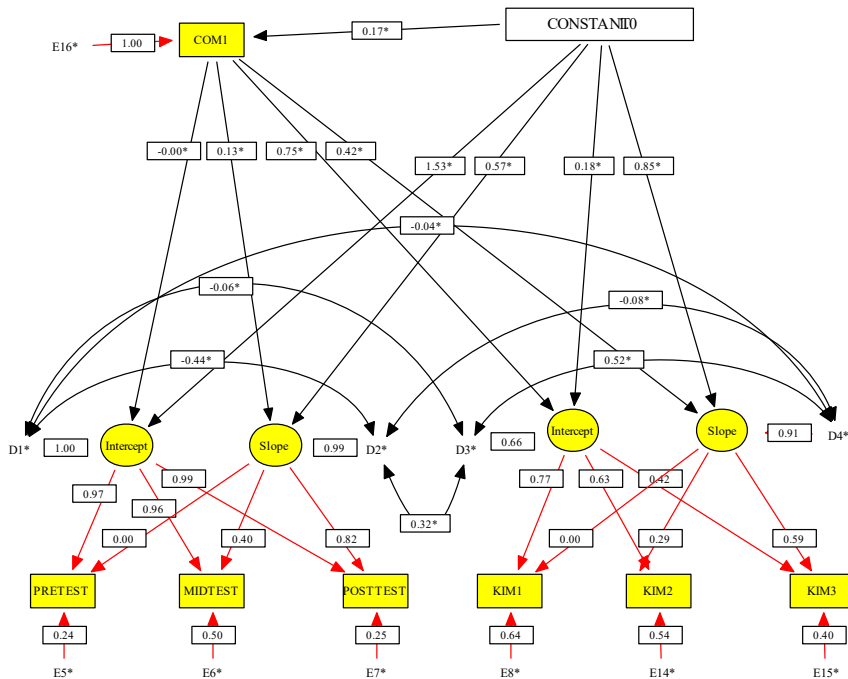


Figure 2: The multivariate associative LGC model with estimated parameters. Note: KIM1, intrinsic motivation for learning kanji at Time 1; KIM2, intrinsic motivation for learning kanji at Time 2; KIM3, intrinsic motivation for learning kanji at Time 3; COM1, perceived competence at Time 1.

included intercepts and slopes for kanji proficiency and intrinsic motivation and another predictor, perceived competence. As with the univariate LGC model, the parameters were estimated with the Satorra-Bentler scales χ^2 corrections for the maximum likelihood method. The model fitted the data well with the following fit indices: $\chi^2_{SB}(9) = 32.502, p < 0.01$, CFI = 0.984, and RMSEA (90% CI) = 0.072 (0.000, 0.127). Figure 2 presents the multivariate LGC model with the estimated parameters.

3.4.2 Development of kanji proficiency and intrinsic motivation

Before the main analysis, this section describes the development of kanji proficiency and intrinsic motivation over time. Table 3 presents means and variances of the intercept and slope for the multivariate associative LGC model. Both intercept and slope means were significant. The growth curve parameters for kanji proficiency at Times 1, 2, and 3 were 0, 0.40, and 0.82, respectively, and 0, 0.29, and 0.59, respectively, for intrinsic motivation. Thus, the participants increased their average kanji proficiency and intrinsic motivation over time. The significant intercept variances

Table 3: Means and variances for the multivariate associative LGC model.

	<i>B</i>	<i>SE B</i>	<i>r</i>	<i>t</i>
Intrinsic motivation for learning kanji				
Means				
Intercept	0.255	0.098		2.598
Slope	0.555	0.063		8.881
Variances				
Intercept	0.876	0.247		3.544
Slope	0.356	0.170		2.089
Covariance between the intercept and slope	0.291	0.130	0.521	2.240
Kanji proficiency				
Means				
Intercept	1.878	0.092		20.329
Slope	0.292	0.039		7.474
Variances				
Intercept	1.515	0.264		5.742
Slope	0.257	0.072		3.598
Covariance between the intercept and slope	−0.276	0.094	−0.441	−2.921

t-values greater than |1.96| (|1.65| for variances) are significant at $p < 0.05$.

indicate a substantial interindividual variation in kanji proficiency and intrinsic motivation, measured initially at Time 1. The significant slope variances show that changes in kanji proficiency and intrinsic motivation over time varied substantially among individuals. The estimated covariance between the intercept and slope for kanji proficiency was negatively significant ($r = -0.441, p < 0.05$), indicating that, for participants with high kanji proficiency at Time 1, their rate of growth in kanji proficiency was lower than that of individuals with low kanji proficiency at Time 1. In other words, participants with low kanji proficiency at Time 1 made greater gains in kanji proficiency than those with high proficiency. In contrast, the estimated covariance between the intercept and slope for intrinsic motivation was positively significant ($r = 0.521, p < 0.05$), indicating that participants with high intrinsic motivation at Time 1 increased their intrinsic motivation at a higher rate than the individuals with low intrinsic motivation at Time 1. Thus, the learners’ general tendencies of intrinsic motivation, measured initially at Time 1, partially regulated the dynamic changes in intrinsic motivation.

3.4.3 Reciprocal development of kanji proficiency and intrinsic motivation

The second research question explored the extent of the association between the developmental trajectories of intrinsic motivation and kanji proficiency. Table 4

Table 4: The correlations between the intercepts and slopes across two domains.

	Kanji Proficiency	
	Intercept	Slope
Intrinsic motivation		
Intercept	−0.063	0.323*
Slope	−0.040	−0.079

* $p < 0.05$.

presents the correlations between the intercepts and slopes across the two domains. As the correlation was not significant between the slopes in kanji proficiency and intrinsic motivation ($r = -0.079$, $p = n.s.$), development of kanji proficiency and intrinsic motivation were not reciprocal. The only significant correlation was between the intercept for intrinsic motivation and the slope for kanji proficiency, which was already demonstrated in the univariate LGC model. The learners' general motivational tendencies, measured initially at Time 1, appear to have more influence than dynamic changes in intrinsic motivation on kanji proficiency development. Furthermore, growth does not significantly cultivate intrinsic motivation in the learners' minds.

3.4.4 Effects of perceived competence on kanji proficiency and intrinsic motivation

The third research question explored the extent to which perceived competence affects the development of intrinsic motivation and kanji proficiency. Table 5 presents the effects of perceived competence on the intercepts and slopes of intrinsic motivation and kanji proficiency. Concerning the effects on intrinsic motivation, paths to the intercept ($\beta = 0.749$) and slope ($\beta = 0.420$) were both significant. Perceived

Table 5: Effects of perceived competence in the multivariate associative LGC model.

Outcome	R^2	B	$SE\ B$	β	t
Intrinsic motivation					
Intercept	0.561	0.534	0.055	0.749	9.784
Slope	0.176	0.139	0.031	0.420	4.504
Kanji proficiency					
Intercept	0.000	−0.003	0.056	−0.004	−0.050
Slope	0.017	0.034	0.024	0.132	1.419

t -values greater than $|1.96|$ are significant at $p < 0.05$.

competence accounted for more than half the variance (56.1%) in the learners' general motivational tendencies, measured initially at Time 1 ($R^2 = 0.561$), and 17.6% of the variance in intrinsic motivation changes ($R^2 = 0.176$). As R^2 values of <0.20 and >0.50 are considered small and large, respectively (Plonsky and Ghanbar 2018), perceived competence had significantly large effects on the learners' initially measured general motivational tendencies and significant yet small effects on the enhancement of intrinsic motivation. In all, perceived competence is an important factor for both static and dynamic aspects of intrinsic motivation. As growth in kanji proficiency was not associated with the changes in intrinsic motivation ($r = -0.079$, $p = n.s.$), perceived competence has more influence than actual growth in kanji proficiency on enhancing intrinsic motivation.

Concerning the effects on kanji proficiency, paths to the intercept and slope were not significant. Further, perceived competence did not explain any variance in initial kanji proficiency (i.e., 0%), and only 1.7% of the variance in the development of kanji proficiency. Overall, perceived competence did not have a direct impact on growth in kanji proficiency. However, as it was a significant predictor of intrinsic motivation, which is a significant positive predictor of growth in kanji proficiency, it can be said that perceived competence had indirect effects on growth in kanji proficiency via intrinsic motivation.

4 Discussion

4.1 Impact of motivation on kanji proficiency

The primary purpose of this study was to examine the impact of motivation on kanji proficiency of L1 Chinese JSL learners. Overall, motivation was differently associated with proficiency levels among the learners (the intercept) and growth in kanji proficiency (the slope). The lack of a relationship between motivation and the varying proficiency levels among the learners indicates that there is no specific motivational pattern at any developmental stage of kanji proficiency from beginning to advanced. The trajectories of kanji learning motivation vary from learner to learner. In contrast, motivation (intrinsic motivation and introjected regulation) had a significant impact on growth in kanji proficiency. While reconfirming the importance of intrinsic motivation in kanji learning (Tanaka 2013), this study failed to demonstrate a significant positive link between mastery goals and growth in kanji proficiency. A possible reason for the null finding is the participants' levels of mastery goals. Although mastery goals had a similar SD to the other variables, the participants had very high mastery goals at the group level ($M = 1.66$ logits). It may be that once learners pass a minimum threshold for mastery goals, greater strength does not

differentiate the degree of growth, regardless of how great it is. Mastery goals are certainly important, as the aspiration to learn and improve further is assumed to promote learning. Unlike intrinsic motivation, however, mastery goals did not have a systematic relationship with the development of kanji proficiency.

While introjected regulation, which is regulated by self-worth, shame, and obligations, may not always have negative effects on L2 learning outcomes, the present study reconfirmed its maladaptive effect in the context of kanji learning by L1 Chinese JSL learners (Tanaka 2013). A possible reason may lie in the dominance of interdependent self-construal in Chinese societies. In societies with a more interdependent self-construal model, people place more value on interconnectedness with relevant others (Markus and Kitayama 1991) and are more oriented to others' standards and social norms (Wong and Tsai 2007). As such, fulfilling requirements for the sake of group expectations can be a significant motivator (Markus and Kitayama 1994). Furthermore, as individuals with a more interdependent view of self emphasize social roles and public evaluation as central to their identity (Wong and Ahuvia 1998), the notion of face has a salient influence on motivation in a Chinese cultural context (Magid 2009). It is well-acknowledged that anxiety induces debilitating effects when it involves intense fear. In a similar vein, as maintaining self-esteem or face is highly valued and emphasized in the Chinese cultural setting, introjected regulation may cause detrimental effects on learners with the intense desire to avoid losing face.

4.2 Perceived competence and the development of kanji proficiency and intrinsic motivation

Concerning the effects of intrinsic motivation on the development of kanji proficiency, while learners' motivational tendencies measured at Time 1 had a significant positive impact on growth in kanji proficiency, changes in intrinsic motivation over time were not correlated with growth in kanji proficiency. As revealed in the Results section, the developmental rate of intrinsic motivation varied greatly among the participants. While intrinsically motivated students at Time 1 enhanced their motivation to a larger extent, less intrinsically motivated students exhibited lesser development in intrinsic motivation. In other words, the developmental rate of intrinsic motivation was partially determined by the learners' general motivational tendencies measured at Time 1. As the general tendencies of intrinsic motivation shape, to a certain extent, how students enhance intrinsic motivation, they may exert a stronger influence on growth in kanji proficiency than the dynamic changes of intrinsic motivation.

Perceived competence is one of the three fundamental factors to promote intrinsic motivation in SDT (Ryan and Deci 2017). Following the theory, perceived competence is

related to both general tendencies and dynamic changes in learners' intrinsic motivation. It must be noted that growth in kanji proficiency was not associated with changes in intrinsic motivation. Given the prominence of perceived competence and the lack of contribution of growth in kanji proficiency in enhancing intrinsic motivation, perceived competence is more important than actual growth for the development of intrinsic motivation. Certainly, growth is important. If there is no progress in learning, despite great efforts exerted over time, it would be difficult for learners to sustain motivation and continue their studies. However, without learners' subjective involvement, growth may not have any influence. In other words, the positive effects of growth on motivation arise when learners perceive it and place a value on it. The awareness of growth brings a sense of joy, the source of intrinsic motivation. Thus, it may be necessary to translate actual growth into perceived competence to increase intrinsic motivation. In contrast, perceived competence did not have any prominent effects on either the varying kanji proficiency levels measured initially at Time 1 or growth in kanji proficiency. However, it exerted salient influences on intrinsic motivation, a significant positive predictor of growth in kanji proficiency. SDT stipulates that perceived competence is an antecedent of motivation (Ryan and Deci 2017). Although perceived competence is a consequence of motivation (Noels et al. 2019) and a direct predictor of achievement (Joe et al. 2017) in certain studies, it served as an antecedent of intrinsic motivation that rendered a direct impact on growth in kanji proficiency of L1 Chinese JSL learners, as stipulated in SDT.

4.3 Implications

The implications of this study's findings are as follows. First, as intrinsic motivation was revealed to be important for kanji proficiency development, it is recommended that teachers devise teaching methodologies to enhance learners' intrinsic motivation. Second, perceived competence, rather than the actual growth in kanji proficiency, played a crucial role in the development of intrinsic motivation, indicating the importance of perceptions of growth and success. Daily learning entails small progress and accomplishment, such as learners being able to do certain things at the end of the lesson that they could not do at the beginning. Teachers may enhance learners' intrinsic motivation by directing learners' attention to such small successes and providing praise.

5 Conclusion

Before concluding, it is important to acknowledge the limitations. First, as is common with longitudinal studies, attrition occurred in the present study. As the participation

was voluntary, with no rewards, many participants did not complete all the measurements across the three time points. Thus, the results may reflect the characteristics of the students who were willing to cooperate with the longitudinal study across the three measurement points. Second, although the present study was longitudinal, one semester is a short duration. Different results may be revealed in a longer-duration longitudinal study. Third, this study employed only quantitative research methodology because of space limitations. Qualitative research data would augment the validity of the current study's findings.

Despite these limitations, this study clarified the impact of motivation on growth in kanji proficiency and the dual developmental trajectories of motivation and kanji proficiency by applying LGC modeling. As the multivariate development of motivation and L2 learning outcomes remain underexplored issues, future research is warranted to comprehensively capture how motivation and L2 proficiency longitudinally develop, along with other relevant factors.

Appendix A

Questionnaire Items (English Translation)

Why are you learning kanji?

Factor 1: Intrinsic motivation for learning kanji (KIM)

- KIM1 Because learning kanji is enjoyable.
 - KIM2 Because learning kanji is interesting.
 - KIM3 Because learning kanji is fun.
 - KIM4 Because I feel pleasure when I discover new things through learning kanji.
 - KIM5 Because I feel pleasure in increasing my kanji knowledge.
 - KIM6 Because I like learning kanji.
-

Factor 2: Identified regulation for learning kanji (KID)

- KID1 Because kanji knowledge is useful in my daily life.
 - KID2 Because kanji knowledge will be useful in the future.
 - KID3 Because kanji knowledge will be necessary in the future.
 - KID4 Because kanji knowledge is important in mastering Japanese.
 - KID5 Because kanji knowledge is absolutely necessary for mastering Japanese.
 - KID6 Because kanji knowledge is useful in mastering Japanese.
-

Factor 3: Introjected regulation for learning kanji (KIJ)

- KIJ1 Because I'd feel ashamed if I was poor at kanji.*
- KIJ2 Because I'd feel ashamed if others thought that I was an incapable student.
- KIJ3 Because I'd feel ashamed if others thought that I was incapable of learning kanji.
- KIJ4 Because I don't want others to think that I don't have a good command of Japanese.
- KIJ5 Because I don't want others to think that I don't have good kanji knowledge.
- KIJ6 Because I don't want others to think that I am slow in acquiring kanji compared to others.

(continued)

Factor 4: External regulation for learning kanji (KEX)

- KEX1 Because I don't want to get low scores on a test such as the Japanese-language proficiency test (JLPT).
- KEX2 Because I don't want to get bad grades.
- KEX3 Because I don't want to fail a test such as the JLPT.
- KEX4 Because I want to get high scores on a test such as the JLPT.
- KEX5 Because I want to get good grades.
- KEX6 Because I want to pass a test such as the JLPT.

Factor 5: Amotivation for learning kanji (KAM)

- KAM1 I won't get anything out of learning kanji.
- KAM2 I don't know what I am getting out of learning kanji.
- KAM3 Learning kanji is useless.
- KAM4 I have never thought about why I must study kanji. Honestly, I'm not interested and I don't care.
- KAM5 I can't see why I must study kanji.
- KAM6 Learning kanji is meaningless.

Factor 6: Mastery goals for learning kanji (MAS)

- MAS1 I want to have kanji knowledge as broad and deep as the Japanese do.*
- MAS2 I want to learn as much kanji as possible.
- MAS3 I want to master the kanji covered in the kanji section of the JLPT.
- MAS4 I want to master the kanji presented in class.
- MAS5 I strive to constantly learn and increase my kanji knowledge.
- MAS6 I want to gain a broader and deeper knowledge of kanji.

Factor 7: Perceived competence (COM)

- COM1 I feel a sense of accomplishment in learning kanji.
- COM2 I feel I can obtain high scores in the kanji section of the JLPT.
- COM3 I feel I can obtain good grades on kanji tests at school.
- COM4 I feel confident in my ability to learn kanji.
- COM5 I am capable of mastering the kanji presented in class.
- COM6 I am able to acquire kanji well.

All the questionnaire items were randomly ordered on a 6-point Likert scale. Items marked with an asterisk [*] were identified as misfitting and, thus, were deleted.

Appendix B

The Correlation Matrix Among the Variables Used in LGC Modeling

Variable	Pre-test	Mid-test	Post-test	KIM1	KIM2	KIM3	COM1	KID1	KIJ1	KEX1	KAM1
Pre-test	–										
Mid-test	0.76	–									
Post-test	0.61	0.76	–								
KIM1	–0.02	0.11	0.20	–							
KIM2	–0.06	0.02	0.05	0.64	–						
KIM3	–0.04	0.06	0.07	0.62	0.76	–					

(continued)

Variable	Pre-test	Mid-test	Post-test	KIM1	KIM2	KIM3	COM1	KID1	KIJ1	KEX1	KAM1
COM1	−0.01	0.10	0.10	0.61	0.55	0.58	–				
KID1	−0.09	0.00	−0.03	0.58	0.45	0.46	0.60	–			
KIJ1	0.08	0.00	−0.04	0.22	0.25	0.24	0.31	0.28	–		
KEX1	−0.03	−0.03	−0.05	0.25	0.28	0.28	0.55	0.49	0.55	–	
KAM1	0.02	−0.01	−0.04	−0.38	−0.30	−0.34	−0.28	−0.47	0.08	−0.15	–
MAS1	−0.05	0.07	0.08	0.61	0.51	0.59	0.76	0.66	0.28	0.52	−0.38

KIM1, intrinsic motivation for learning kanji at Time 1; KIM2, intrinsic motivation for learning kanji at Time 2; KIM3, intrinsic motivation for learning kanji at Time 3; COM1, perceived competence at Time 1; KID1, identified regulation for learning kanji at Time 1; KIJ1, introjected regulation for learning kanji at Time 1; KEX1, external regulation for learning kanji at Time 1; KAM1, amotivation for learning kanji at Time 1; MAS1, mastery goals for learning kanji at Time 1.

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