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# **Reanalysis of “Timing Effects of Listing Gratitude toward One’s Parent(s) on Subjective Well-Being in Japanese Undergraduate Students**

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## **Author Note**

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## **Abstract**

The data of published paper (Kobayashi, 2017) that had been analyzed by multivariate analysis of variance was reanalyzed by multivariate analysis of covariance. The reanalysis was able to offer clearer results than the original analysis did. The condensed gratitude listing practice seemed effective to increase subjective happiness and affect balance with medium size effects ( $0.50 < \text{Cohen's } ds < 0.80$ ), and the spaced-apart gratitude listing practice seemed effective to increase subjective happiness, affect balance, and life satisfaction with small size effects ( $0.20 < \text{Cohen's } ds < 0.50$ ). All the findings, including statistically nonsignificant findings, were reported for the sake of future meta-analysis.

*Keywords:* gratitude, Japan, positive psychology, parent

Previously, I tested the effects of gratitude listing toward one's parent(s) with two different timings with the same amount of practice regarding subjective well-being (Kobayashi, 2017). Seventy-five participants were randomly assigned to three different groups. Those who were in Group A ( $n = 25$ ) listed their gratitude toward their parents every day for six days for a total of six times. Those who were in Group B ( $n = 25$ ) listed their gratitude toward their parents once a week for five weeks for a total of six times. Those who were in Group C ( $n = 25$ ) did nothing. All participants answered three measurements (i.e., subjective happiness, positive and negative affect, and life satisfaction) three times: Time 1 (pre-test), Time 2 (seven days later) and Time 3 (36 days later). I analyzed the data by a 3 (between subjects: treatment group) X 3 (within subjects: time of assessment) multivariate analysis of variance with three dependent variables: subjective happiness, affect balance, and life satisfaction, following univariate tests for each variable, and post-hoc tests with a Bonferroni adjustment. I interpreted the results with  $p$  values, effect sizes and confidence intervals (CIs), instead of relying solely on  $p$  values. Nevertheless, the results were still quite unclear from the analysis.

Several scholars in different disciplines, such as medicine (Van Breukelen, 2006; Vickers & Altman, 2001) and dentistry (Lehnhoff & Grainger, 1974; Tu, Blance, Clerehugh, & Gilthorpe, 2005) recommended using analysis of covariance (ANCOVA) with a pre-test as a covariate instead of repeated measures analysis of variance (RM-ANOVA) when a researcher analyzes the data from a randomized study. There are at least two major advantages of ANCOVA over RM-ANOVA. In general, an ANCOVA offers (a) more accurate estimation of true effect size because it deals with regression to the mean and (b) more statistical power than RM-ANOVA does. Therefore, I reanalyzed the data with a 3 (between subjects: treatment group) X 2 (within subjects: time of assessment) multivariate analysis of covariance of three dependent variables with their pre-test scores as the covariates, following univariate tests for each variable, and post-hoc tests with a Bonferroni adjustment. The results were interpreted by considering effect sizes and confidence intervals (Cumming, 2012, 2014). Regarding visual interpretations of the relationships between two independent means or between two related means with their confidence intervals in the figures, I referred to the guidelines of the New Statistics (See Cumming, 2012, pp. 153-179 & 2014, pp. 18-20) and ignored the  $p$  values. The “overlap rule for two independent means”

(Cumming, 2012, p. 158) applies only to the comparison between confidence intervals of the different groups in the same time phase in Figures 1 through 3. When I calculated the effect sizes, I followed the guidelines of the New Statistics (See Cumming, 2012, pp. 281-298). When I interpreted the size of Cohen's  $d$ , I used 0.20 as small, 0.50 as medium, and 0.80 as large, for the criterion score of each category (Cohen, 1992).

As in Kobayashi (2017), the goal of this re-analysis is to show how the subjective well-being of participants in each group changes instead of conducting some hypotheses tests.

Due to the nature of reanalysis, I did not include the backgrounds, participants, materials, nor procedure of the original study in this paper. These were described in the original paper (Kobayashi, 2017).

## Results

A 3 (between subjects: treatment group) X 2 (within subjects: time of assessment) multivariate analysis of covariance (MANCOVA) was conducted on the three dependent variables (i.e., subjective happiness, affect balance, and life satisfaction) with their pre-test scores as the covariates.

Before conducting the MANCOVA, the following assumptions were assessed, (a) correlation between the covariates and the dependent variables, (b) normal distribution of the dependent variables across the independent variable groups, (c) homogeneity of variances across the independent variable groups, (d) homogeneity of regression slopes across the independent variable groups, (e) reliability of each covariate, and (f) independence of the covariate across the independent variable groups. Although the assumptions of homogeneity of variance regarding subjective happiness and life satisfaction were violated, such violations were ignored because each group had the same number of participants (see Field, 2013, p. 194). All other assumptions were met in all dependent variables.

The MANCOVA results revealed significant multivariate effects across the interaction between group and time,  $V = .21$ ,  $F(6, 136) = 2.60$ ,  $p = .020$ ,  $\eta_p^2 = .10$ . However, no significant multivariate effects were found on time,  $V = .11$ ,  $F(3, 67) = 2.73$ ,  $p = .051$ ,  $\eta_p^2 = .11$  and group,  $V = .11$ ,  $F(6, 136) = 1.30$ ,  $p = .261$ ,  $\eta_p^2 = .05$ . Subsequently, a 3 (between subjects: treatment group) X 2 (within subjects: time of assessment) analysis of covariance (ANCOVA) was conducted on each dependent variable with each pre-test score as the covariate.

The results of ANCOVA on subjective happiness indicated significant effects on time,  $F(1, 69) = 6.19, p = .015, \eta_p^2 = .08$  and group,  $F(2, 69) = 3.71, p = .029, \eta_p^2 = .10$ . However, no significant effect was found on the interaction between group and time,  $F(2, 69) = .48, p = .621, \eta_p^2 = .01$ .

Regarding subjective happiness, all the results of post-hoc tests with a Bonferroni adjustment were reported in Table 2. As you can see in Table 2 and Figure 1, Group A became higher than both Group B (mean difference = 1.29, 95% CI [-0.12, 2.70], Cohen's  $d = 0.63$ ) and Group C (mean difference = 1.56, 95% CI [0.13, 2.98], Cohen's  $d = 0.76$ ) at Time 2 with medium size effects, and Group B (mean difference = 0.62, 95% CI [-0.32, 1.56], Cohen's  $d = 0.26$ ) increased the score from Time 2 to Time 3 with a small size effect, and the effect of Group A continued until Time 3 (mean difference = 0.07, 95% CI [-0.86, 1.00], Cohen's  $d = 0.03$ ).

The results of ANCOVA on affect balance indicated significant effects on the interaction between group and time,  $F(2, 69) = 5.98, p = .004, \eta_p^2 = .15$ . However, no significant effect was found on time,  $F(1, 69) = 1.74, p = .191, \eta_p^2 = .03$  and group,  $F(2, 69) = 0.86, p = .427, \eta_p^2 = .02$ .

Regarding affect balance, all the results of post-hoc tests with a Bonferroni adjustment were reported in Table 3. As you see in Table 3 and Figure 2, Group A became higher than both Group B (mean difference = 5.51, 95% CI [-0.41, 11.43], Cohen's  $d = 0.64$ ) and Group C (mean difference = 4.66, 95% CI [-1.31, 10.63], Cohen's  $d = 0.54$ ) at Time 2 with medium size effects, and Group B (mean difference = 4.50, 95% CI [0.23, 8.77], Cohen's  $d = 0.46$ ) increased the score from Time 2 to Time 3 with a small size effect, and the effect of Group A disappeared at Time 3 (mean difference = -5.77, 95% CI [-10.00, -1.54], Cohen's  $d = -0.59$ ).

The results of ANCOVA on life satisfaction indicated no significant effects on the interaction between group and time,  $F(2, 69) = 2.77, p = .07, \eta_p^2 = .07$ , and time,  $F(1, 69) = 0.31, p = .577, \eta_p^2 = .01$ , and group,  $F(2, 69) = 0.38, p = .689, \eta_p^2 = .01$ .

Regarding life satisfaction, all the results of post-hoc tests with a Bonferroni adjustment were reported in Table 4. As you see in Table 4 and Figure 3, only Group B (mean difference = 1.27, 95% CI [-0.12, 2.66], Cohen's  $d = 0.34$ ) increased the score from Time 2 to Time 3 with a small size effect.

## Discussion

First, regarding subjective happiness, Group A became higher than both Group B and Group C at Time 2 with medium size effects, and Group B increased the score from Time 2 to Time 3 with a small size effect, and the effect of Group A continued until Time 3. Such findings indicated that the condensed gratitude listing practice seemed effective to increase one's subjective happiness and this effect continued for four weeks. Indeed, these findings have already been demonstrated by previous studies (Gander, Proyer, Ruch, & Wyss, 2013; Seligman, Steen, Park, & Peterson, 2005). The increase from Time 2 to Time 3 of those who conducted the spaced-apart gratitude listing practice was small.

Second, regarding affect balance, Group A became higher than both Group B and Group C at Time 2 with medium size effects, and Group B increased the score from Time 2 to Time 3 with a small size effect, and the effect of Group A disappeared at Time 3. Such findings indicated that the condensed gratitude listing practice seemed effective to increase one's affect balance and this effect did not continue for four weeks after the termination of such a gratitude practice. The increase from Time 2 to Time 3 of those who conducted the spaced-apart gratitude listing practice was small.

Third, affect balance of Group A decreased from Time 2 to Time 3 with a medium size effect. Additionally, affect balance of Group C seemed to decrease from Time 1 to Time 3. As I mentioned in the original study (Kobayashi, 2017), such results might be influenced by the particular semester schedule in which the study was held. At the beginning of the semester, there is not much school work and most of the participants started their assignments at that time. However, the amount of school work increased as the semester went by and it might have had a negative influence on their affect balance.

Fourth, regarding life satisfaction, only Group B increased the score from Time 2 to Time 3 with a small size effect. Such findings indicated that it may be effective to conduct the spaced-apart gratitude listing practice to increase one's life satisfaction somewhat.

In summary, the condensed gratitude listing practice seemed effective to increase one's subjective happiness and affect balance with medium size effects ( $0.50 < \text{Cohen's } ds < 0.80$ ), and the spaced-apart gratitude listing practice seemed effective to increase one's subjective happiness, affect balance, and life satisfaction with small size effects ( $0.20 < \text{Cohen's } ds < 0.50$ ).

I assume such findings are interesting because previous research (Lyubomirsky, Sheldon, & Schkade, 2005) and an authority (Emmons, 2013) suggested more effectiveness of the spaced-apart gratitude listing practice than the condensed gratitude listing practice. As

I mentioned in the original study (Kobayashi, 2017), it is still unclear to me why the condensed gratitude listing practice seemed ineffective to increase one's life satisfaction although it was effective to increase one's subjective happiness and affect balance. In addition, the effect of the condensed gratitude listing practice lasted for four more weeks after the termination of the practice in terms of subjective happiness but not affect balance. This is logical because subjective happiness is an evaluation of one's state and affect balance is based on one's feelings. Feelings fluctuate heavily more than cognitive appraisals.

As I mentioned in the original study (Kobayashi, 2017), there are several shortcomings in this study. First of all, it is based on a small, convenience sample from a particular institution. Second, the self-serving bias could exist in the results because the research relied on self-reports of the participants. Third, the participants of the study might be qualitatively different from a general population in Japan because they study almost all of their courses that are conducted in English in their school life.

Although this study has various shortcomings, I am relieved to report clearer results than the original study did. I believe more studies are necessary to investigate gratitude intervention issues. For the sake of future meta-analysis, all the findings, including nonsignificant results, are reported.

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**Table 1.***Means, Standard Errors, and 95% Confidence Intervals by Condition and Time of Assessment*

DV	Condition	<i>n</i>	Time of Assessment			
			Time 2 ( <i>SE</i> )	95% CI	Time 3 ( <i>SE</i> )	95% CI
Subjective Happiness	Group A	25	20.04 (0.41)	[19.23, 20.85]	20.11 (0.53)	[19.05, 21.18]
	Group B	25	18.75 (0.41)	[17.93, 19.57]	19.37 (0.54)	[18.30, 20.44]
	Group C	25	18.49 (0.41)	[17.67, 19.31]	18.52 (0.54)	[17.44, 19.60]
Affect Balance	Group A	25	11.30 (1.70)	[7.90, 14.69]	5.52 (2.18)	[1.19, 9.86]
	Group B	25	5.79 (1.72)	[2.36, 9.22]	10.29 (2.20)	[5.91, 14.67]
	Group C	25	6.63 (1.73)	[3.19, 10.08]	4.47 (2.21)	[0.07, 8.87]
Life Satisfaction	Group A	25	20.28 (0.72)	[18.85, 21.71]	20.38 (0.74)	[18.90, 21.87]
	Group B	25	19.56 (0.72)	[18.12, 21.00]	20.83 (0.75)	[19.33, 22.33]
	Group C	25	20.12 (0.73)	[18.67, 21.57]	19.03 (0.76)	[17.52, 20.54]

*Note.* *SE* = standard error, CI = confidence interval, DV = dependent variable.

**Table 2.***t values, p values, Mean Differences, 95% Confidence Intervals, and Cohen's d of Subjective Happiness by Pairs and Times of Assessment*

Time	Pairs(i-ii)	<i>t</i> (24)	<i>p</i>	Mean Difference(i-ii)	95% CI	Cohen's <i>d</i>
2	A-B	2.24	.084	1.29	[-0.12, 2.70]	0.63
2	A-C	2.69	.028	1.56	[0.13, 2.98]	0.76
2	B-C	0.45	1.000	0.26	[-1.18, 1.71]	0.13
2-3	A3-A2	0.15	.880	0.07	[-0.86, 1.00]	0.03
2-3	B3-B2	1.31	.194	0.62	[-0.32, 1.56]	0.26
2-3	C3-C2	0.06	.950	0.03	[-0.92, 0.98]	0.01
3	A-B	0.98	.984	0.74	[-1.11, 2.60]	0.28
3	A-C	2.10	.120	1.60	[-0.27, 3.47]	0.59
3	B-C	1.12	.821	0.85	[-1.04, 2.75]	0.32

*Note.* CI = confidence interval; "A3" means "Group A at Time 3".

**Table 3.***t values, p values, Mean Differences, 95% Confidence Intervals, and Cohen's d of Affect Balance by Pairs and Times of Assessment*

Time	Pairs(i-ii)	<i>t</i> (24)	<i>p</i>	Mean Difference(i-ii)	95% CI	Cohen's <i>d</i>
2	A-B	2.28	.076	5.51	[-0.41, 11.43]	0.64
2	A-C	1.92	.178	4.66	[-1.31, 10.63]	0.54
2	B-C	-0.35	1.000	-0.85	[-6.90, 5.21]	-0.10
2-3	A3-A2	-2.72	.008	-5.77	[-10.00, -1.54]	-0.59
2-3	B3-B2	2.10	.039	4.50	[0.23, 8.77]	0.46
2-3	C3-C2	-1.01	.318	-2.17	[-6.46, 2.13]	-0.22
3	A-B	-1.54	.380	-4.76	[-12.33, 2.80]	-0.44
3	A-C	0.34	1.000	1.05	[-6.58, 8.68]	0.10
3	B-C	1.87	.207	5.82	[-1.91, 13.55]	0.53

*Note.* CI = confidence interval; "A3" means "Group A at Time 3".

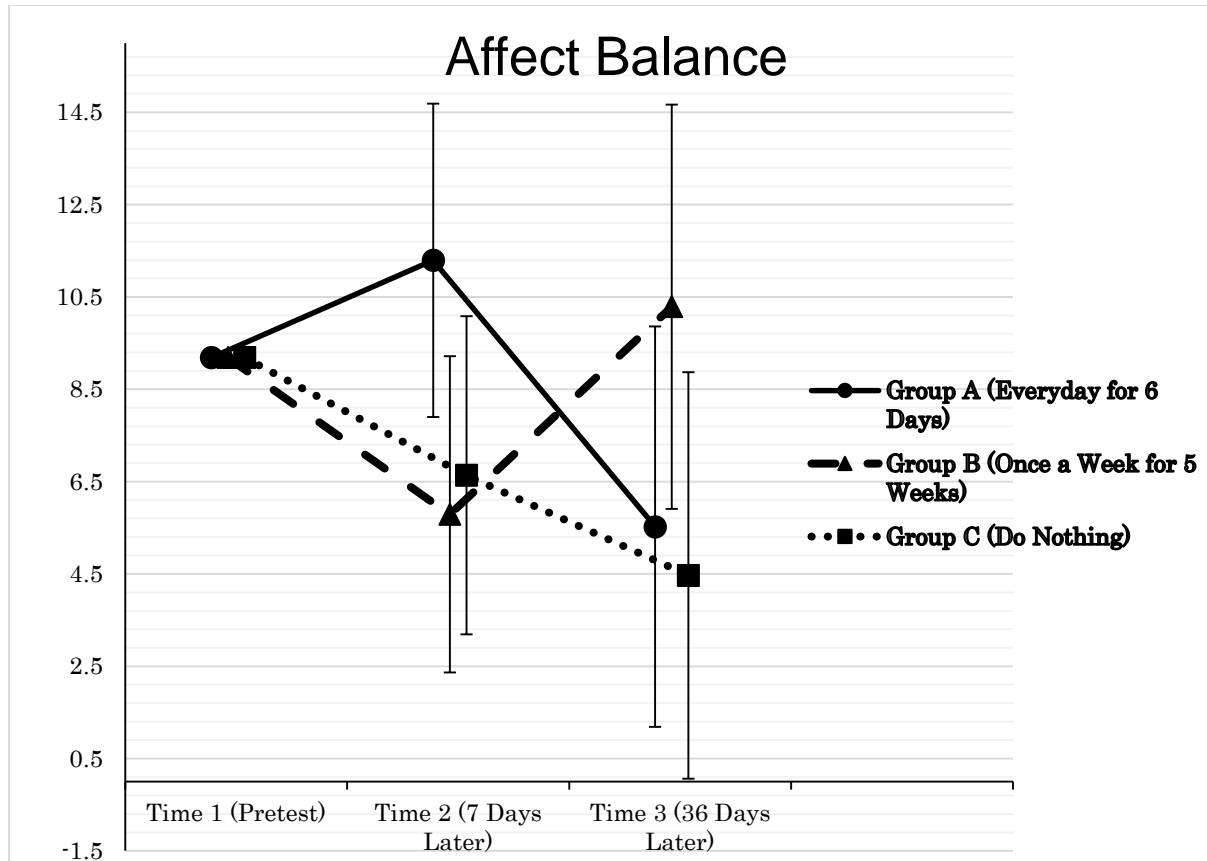
**Table 4.***t values, p values, Mean Differences, 95% Confidence Intervals, and Cohen's d of Life Satisfaction by Pairs and Times of Assessment*

Time	Pairs(i-ii)	<i>t</i> (24)	<i>p</i>	Mean Difference(i-ii)	95% CI	Cohen's <i>d</i>
2	A-B	0.70	1.000	0.72	[-1.78, 3.21]	0.20
2	A-C	0.15	1.000	0.16	[-2.36, 2.67]	0.04
2	B-C	-0.55	1.000	-0.56	[-3.11, 1.99]	-0.15
2-3	A3-A2	0.15	.882	0.10	[-1.28, 1.48]	0.03
2-3	B3-B2	1.82	.074	1.27	[-0.12, 2.66]	0.34
2-3	C3-C2	-1.55	.125	-1.09	[-2.49, 0.31]	-0.29
3	A-B	-0.42	1.000	-0.45	[-3.04, 2.14]	-0.12
3	A-C	1.27	.626	1.35	[-1.26, 3.96]	0.36
3	B-C	1.69	.301	1.80	[-0.85, 4.45]	0.48

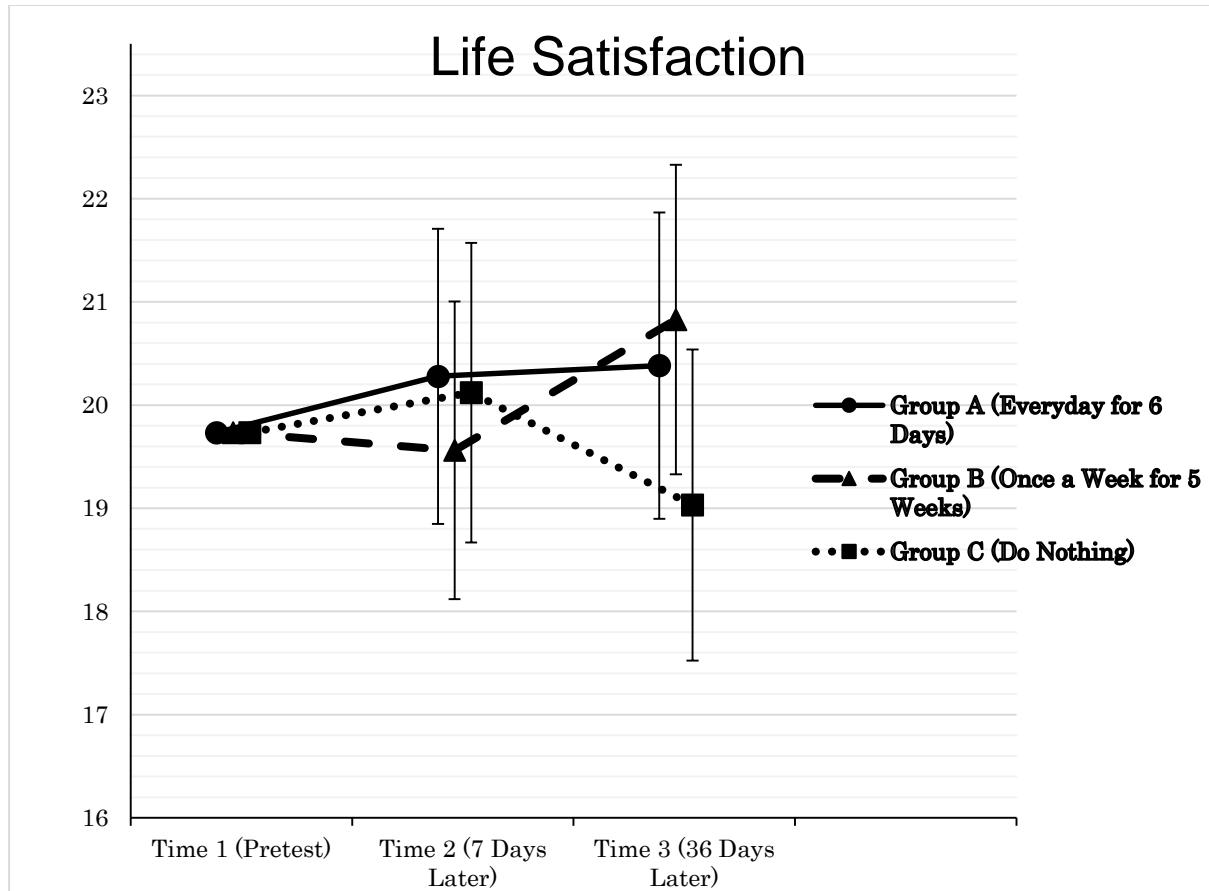
*Note.* CI = confidence interval; "A3" means "Group A at Time 3".



*Figure 1.* Changes of subjective happiness at three time periods: Time 1 (Pretest), Time 2 (7 days later) and Time 3 (36 days later). Error bars indicate 95% confidence intervals. All scores at Time 1 represent the pretreatment grand mean (19.13) because the pretest score was used as a covariate in analysis of covariance. The overlap rule for two independent means applies only to the comparison between confidence intervals of the different groups in the same time phase.



*Figure 2.* Changes of affect balance at three time periods: Time 1 (Pretest), Time 2 (7 days later) and Time 3 (36 days later). Error bars indicate 95% confidence intervals. All scores at Time 1 represent the pretreatment grand mean (9.19) because the pretest score was used as a covariate in analysis of covariance. The overlap rule for two independent means applies only to the comparison between confidence intervals of the different groups in the same time phase.



*Figure 3.* Changes of life satisfaction at three time periods: Time 1 (Pretest), Time 2 (7 days later) and Time 3 (36 days later). Error bars indicate 95% confidence intervals. All scores at Time 1 represent the pretreatment grand mean (19.73) because the pretest score was used as a covariate in analysis of covariance. The overlap rule for two independent means applies only to the comparison between confidence intervals of the different groups in the same time phase.