Statistical evidence of the correlational and predictive ability of the Creative Achievement Questionnaire assessment with the creativity scores of the participants

ABSTRACT

While the divergent thinking tasks have proven to be widely popular in the assessment of creativity, this paper aimed to analyze the effectiveness of the Creative Achievement scores in their ability to correlate and predict the creativity of participants. The study provides statistical evidence of the correlational and predictive ability of the Creative Achievement Questionnaire assessment with the creativity scores of the participants. However, as expected, it does not have any significant correlation with creativity being measured as a fluent number of responses task in the fluency task. This study involved 33 participants across age groups including the cohorts of 2023 and 2024 batches of the PANC program. Their data was collected to analyze their creativity score, fluency score and determine their overall creative achievement scores. A correlational analysis was run on Jamovi and the results of the correlation between creativity and creative achievement score was found to be significant. There were no significant effects based on task order and stimuli order which varied across participants in the divergent tasks. Further, Fluency scores – the fluent number of responses of the participants showed no correlation with the creative achievement score, showcasing that, the instruction “be creative” in the creativity task does have a larger effect in correlating with the creative achievement scores of the participants.

INTRODUCTION

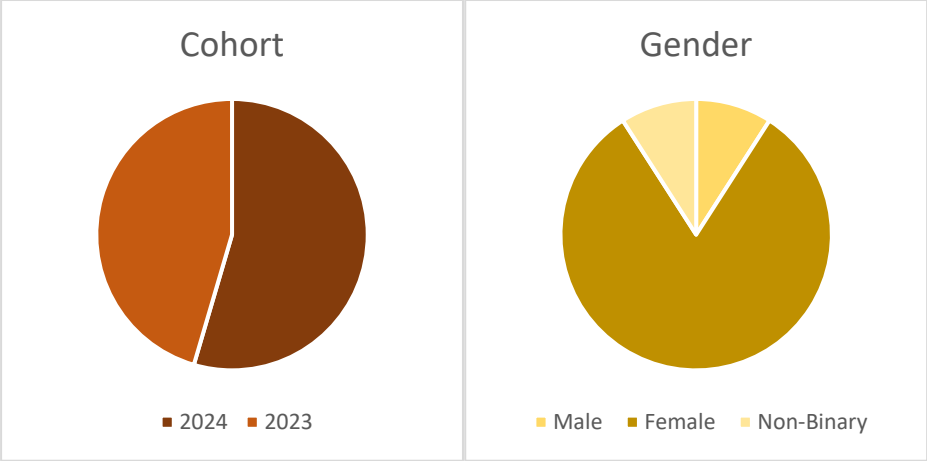
Divergent Thinking tasks were popularized by the works of J.P Guilford in 195O. He aimed to provide proof for studying creativity objectively while dedicating the next 35 years of his life to doing so (Runco 2014). While Guilford's structure of intellectual model received criticism (Carroll 1968, as cited in Runco 2014) his models on divergent and convergent thinking have been seen as useful and influential (Runco 1999d, as cited in Runco 2014). Furthering the Divergent Thinking tasks methodology, Nusbaum et al.,2014 tried to identify the effects of instructing the participants to "be creative" and its effect on the DT task. While the study analyzed fluid intelligence and divergent thinking scores of the participants, the researchers found that the subjective quantification of the "be creative" instruction for the creativity score was strongly predicted by intelligence whereas the fluent answers in the divergent thinking task when scored as creativity was weakly predicted by the intelligence scores.

Similar to this study, this paper analyzed the ability of the Creative Achievement score to predict and its correlational value with the creativity score of participants. The Creative Achievement Questionnaire (CAQ) as seen in the research of Carson et al.,2015 was recreated and analyzed accordingly for this study. The CAQ analyses the participant's creativity across various domains of creative and scientific achievements. It is a self-assessment questionnaire and the total points allotted to each of the achievements across the domains are then totalled in a particular manner to arrive at the final creative achievement score. An article about Vincent Van Gogh (*Vincent Van Gogh Paintings, Bio, Ideas*, n.d.) cites that he created 900 paintings and 1100 sketches and drawings, and sold only one painting during his lifetime. Were Van Gogh to take the CAQ during his lifetime, the structure of the evaluation of CAQ would not allow him to be termed as highly creative. While this could raise questions about the CAQ assessment methodology, it has been found to be effective and termed a 'clever scale' by Silvia., et al 2012, additionally, the researchers also delve deeper into understanding multiple aspects of the CAQ in their paper. The procedures and the results of the effects of the CAQ on the creativity scores of the participants are described in the following paper.

METHOD

This section of the paper discusses the research process, including the details of the participants, methods, research design, and description of the various tools employed to conduct the divergent thinking tasks and the overall procedure.

1. **Participants:** The study involved 33 participants across two academic years of study at the Psychology of Arts, Neuroaesthetics and Creativity Master's program. The sample consisted of 17 participants from the 2024 cohort while the rest of the participants were from the 2023 cohort. Of these, there were three male participants, 27 Female participants and three non-binary participants.



2. **Materials used for the study:** For the divergent thinking task, two tasks were presented to the participants for understanding Fluency Scores and Creativity Scores as seen in the experiments by Nusbaum et al. (2014). In one of the tasks, Participants were asked for alternate uses of an object while being fluent with the number of their responses (either a box or a rope) and in another task, participants were instructed to be creative while answering for alternative uses of one of the objects prompted in their survey (a box or a rope). The order of these two tasks and the target object given to each participant for each task varied across all participants. All the participants were given three minutes to finish their answers.

   Consequently, Participants were asked to fill out the Creative Achievement Questionnaire (CAQ) as formulated in the paper by Carson et al. (2015). Part one of the questionnaire measures their achievements across 13 different fields of talent (inclusive of 10 domains of artistic and scientific creativity included in the second part of the questionnaire and additionally, the list included individual sports, team sports and Entrepreneurial ventures). The second part of the questionnaire included achievements across 10 domains of artistic and scientific endeavour – Visual art, Music, Dance, Creative writing, Architectural Design, humour, theatre and film, culinary arts, inventions, and scientific enquiry. The participants were asked to checkmark all the options under each domain describing their accomplishments in the domain. Each of the domains has accomplishments ranging from 0 to 7. The starting range of 0 weighted points states "I have no training or recognized talent in this area". The Next weighted

point of one weight value states ‘I have taken lessons in this area” and the consecutive weighted points scale in ascending order of training and accomplishment levels. In the 7the weighted point, Participants also stated the number of times each award/achievement/scientific endeavour had been earned.

3. **Design:** The design for the experiment in part one of the divergent thinking tasks for being fluent and creative included a qualitative analysis. Assessments were made by taking into consideration all the answers written by the participants. The second part of the experiment scored all the CAQ values to arrive at a Total CAQ value for each participant. All the values of achievements across domains were calculated based on the checked number by the participants. The value of the 7th weighted value of having won significant awards in a particular domain was multiplied by the number of times the awards were won to arrive at the final weighted point. All the weighted points from 0-7 were then added to arrive at the Total CAQ for each participant. A correlational matrix was used to analyse any significant correlation between the creativity scores and the Total CAQ scores. Further, a repeated Measures ANOVA was implemented to check if there were any significant effects due to the task order and object(box/rope) stimuli order. DEPENDENT INDEPENDENT VARIABLES?

4. **Procedure:** The 2023 and 2024 cohort were sent a link to the online questionnaire and were asked to answer them in the allotted time based on the instructions in the survey. The anonymous data collected from the participants were then analysed using Jamovi. As the answers were known to vary across participants and given the age differences between participants which would influence their achievements, Normality tests on Fluency score, creativity score and CAQ total scores were not considered.

RESULTS

This section of the paper discusses the Results of the statistical analysis

TABLE 1

Correlational Matrix between Fluency score, Creativity Score and the Total CAQ values

Correlation Matrix

		creative_score	Fluency_Score	CAQTotal
creative_score	Pearson's r	—		
	df	—		
	p-value	—		
	Spearman's rho	—		
	df	—		
	p-value	—		
	Kendall's Tau B	—		
	p-value	—		
Fluency_Score	Pearson's r	0.213	—	0.177
	df	31	—	31
	p-value	0.234	—	0.325
	Spearman's rho	0.253	—	0.283
	df	31	—	31
	p-value	0.155	—	0.110
	Kendall's Tau B	0.198	—	0.226
	p-value	0.144	—	0.079
CAQTotal	Pearson's r	0.412 *	0.177	—
	df	31	31	—
	p-value	0.017	0.325	—
	Spearman's rho	0.350 *	0.283	—
	df	31	31	—
	p-value	0.046	0.110	—
	Kendall's Tau B	0.257	0.226	—
	p-value	0.054	0.079	—

Note. * p < .05, ** p < .01, *** p < .001

The results show a positive correlation between the creativity score and the total CAQ scores, **r(31) = .41, p = .017**. The Spearman's rank correlation was computed to assess the relationship between the creativity score and the Total CAQ score as well. There was a positive correlation between the two variables, **r(31) = .35, p = .046**. The correlational plot is provided in the appendix.

TABLE 2

Model Fit Measures

				Overall Model Test			
Model	**R**	**R^2**	**Adjusted R^2**	**F**	**df1**	**df2**	**p**
1	0.412	0.169	0.143	6.32	1	31	0.017

Model Coefficients - creative_score

Predictor	**Estimate**	**SE**	**t**	**p**
Intercept	1.3471	0.3843	3.50	0.001
CAQTotal	0.0369	0.0147	2.51	0.017

A simple Linear regression analysis was conducted to evaluate the extent to which the Total CAQ score, the independent variable in this experiment could predict the Creativity score, the dependent variable. The linear regression analysis revealed a statistically significant model (F(1,31) = 6.32, p = .017), with an adjusted R^2 of 0.14. This finding suggests that the Creative Achievement Questionnaire score accounts for approximately 14% of the variance in Creativity scores among the participants

Further, the regression coefficient for Total CAQ was found to be 0.03, with a standard error of 0.01. This indicates that for each additional point of the Total CAQ score, the creativity score increases by an average of 0.03. This positive relationship between creativity score and Total CAQ was found to be statistically significant (t(32) = 2.51, p = 0.017), affirming the predictive power of the Total CAQ on creativity score.

TABLE 3a

Between Subjects Effects

	Sum of Squares	**df**	**Mean Square**	**F**	**p**	**η^2**	**η^2_p**
Task order (1= fluent first / 2 = creative first)	49.9	1	49.9	3.32	0.078	0.031	0.097
Residual	465.8	31	15.0				

Note. Type 3 Sums of Squares

TABLE 3b

Within Subjects Effects

	Sum of Squares	df	Mean Square	F	p	η^2	η^2_p
RM Factor 1	705.62	1	705.62	55.256	< .001	0.436	0.641
RM Factor 1 ✻ Stimulus order (1 = rope first / 2= box first)	3.07	1	3.07	0.241	0.627	0.002	0.008
Residual	395.87	31	12.77				

Note. Type 3 Sums of Squares

A repeated measures ANOVA was performed to evaluate the effect of the task order within subjects and stimuli order between subjects on the creativity and fluency scores.

The between-subjects effect of the task order on the creativity and Fluency scores was not significant at the 0.05 alpha level, $F(1,31) = 3.32$, $p = 0.078$, partial $\eta^2 = 0.097$.

The within-subjects effect of stimulus order on creativity and fluency score was not significant at the 0.05 alpha level, $F(1,31) = 0.241$, $p = 0.627$, partial $\eta^2 = 0.008$.

DISCUSSION

This study analyzed the effect of the Divergent thinking task while underscoring the effect on the number of unique responses while participants were instructed to ‘be creative’ in task 2 along with being fluent with the number of their responses in task 1. The study aimed to understand the relationship between creative achievement and the participant's creativity scores to see if the creative achievements had any correlations with the creativity scores.

The effects of the task order and stimuli divided across participants did not show in the analysis to have had any effect on the total scores for the participant's fluency or creativity. The calculation of the fluency score and Creativity scores was calculated according to the research by Nusbaum et al (2014). A clear understanding of a structure to score the divergent thinking tasks can also be found in the research of Reiter-Palmon, R at al (2019). The creativity score does seem to be positively correlated with the participants’ total CAQ score showing that the creative achievements of the participants do provide some correlational evidence towards the creativity of the participants, however, it does not show any correlation with the fluency scores.

Some notable issues in the CAQ scoring have been discussed by other researchers (Silvia. P.J et al 2012). In addition to the important aspect of understanding how honest, or the

confusion in the adequacy of a response by participants when they check only the higher scores without checking the earlier scales of achievement as the achievements move in an ascending order on the scale, the CAQ also does not consider the age of participants when conducted in a mixed age group scenario. The age of the participants could also verily contribute to higher levels of achievements in some cases in comparison to participants who have an age difference of being about 30-plus years younger, for example. This tests the normal distribution of the variables, while not having a significant effect on the scores themselves. Further, as the tests are conducted in English, the CAQ does not account for individual differences in language either. These individual differences have also been elaborated in the research of Zabelina, D.L., et al (2022).

REFERENCES

Mark A. Runco, Chapter 1 - Cognition and Creativity, Editor(s): Mark A. Runco, Creativity (Second Edition), Academic Press, 2014, Pages 1-38, ISBN 9780124105126, https://doi.org/10.1016/B978-0-12-410512-6.00001-1. (https://www.sciencedirect.com/science/article/pii/B9780124105126000011)

Nusbaum, E. C., Silvia, P. J., & Beaty, R. E. (2014, May 5). Ready, Set, Create: What Instructing People to "Be Creative" Reveals About the Meaning and Mechanisms of Divergent Thinking. Psychology of Aesthetics, Creativity, and the Arts. Advance online publication. http://dx.doi.org/10.1037/a0036549

Reiter-Palmon, R., Forthmann, B., & Barbot, B. (2019). Scoring divergent thinking tests: A review and systematic framework. *Psychology of Aesthetics, Creativity, and the Arts, 13*(2), 144–152. https://doi.org/10.1037/aca0000227

Shelley H. Carson , Jordan B. Peterson & Daniel M. Higgins (2005) Reliability, Validity, and Factor Structure of the Creative Achievement Questionnaire, Creativity Research Journal, 17:1, 37-50, DOI: 10.1207/s15326934crj1701_4

Silvia, Paul J.; Wigert, Benjamin; Reiter-Palmon, Roni; and Kaufman, James C., "Assessing Creativity With Self-Report Scales : A Review and Empirical Evaluation" (2012). Psychology Faculty Publications. 54. https://digitalcommons.unomaha.edu/psychfacpub/54

Zabelina, D. L., Zaonegina, E., Revelle, W., & Condon, D. M. (2022). Creative achievement and individual differences: Associations across and within the domains of creativity. *Psychology of Aesthetics, Creativity, and the Arts, 16*(4), 618–636. https://doi.org/10.1037/aca0000439

Vincent van Gogh Paintings, Bio, Ideas. (n.d.). The Art Story. https://www.theartstory.org/artist/van-gogh-vincent/#:~:text=In%20his%20lifetime%2C%20Van%20Gogh,were%20left%20to%20brother%20Theo.

APPENDICES

Appendix 1: List of Abbreviations

CAQ - Creative Achievement Questionnaire

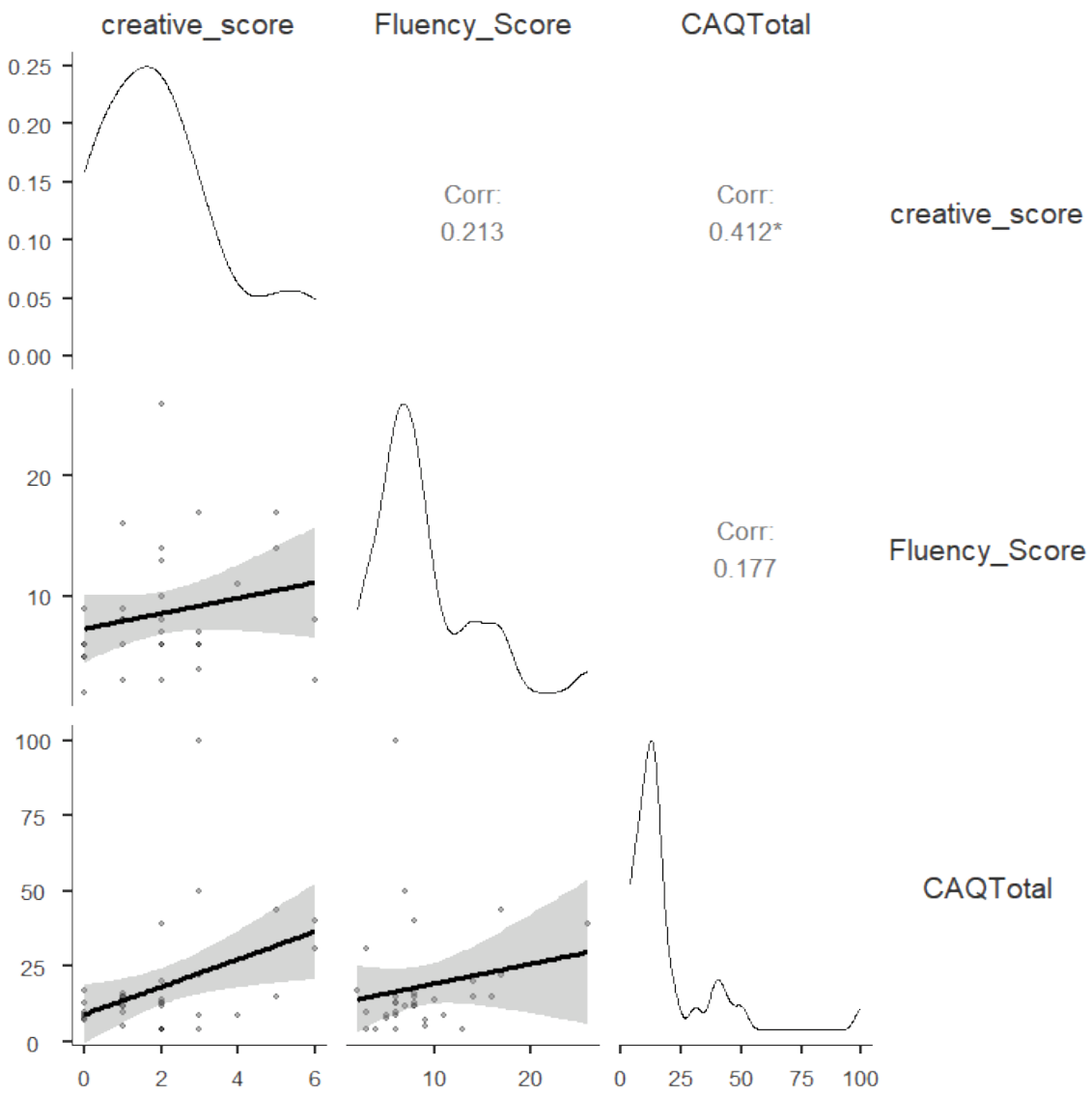
CAQ TOTAL – Creative Achievement Questionnaire Total score

Creative_score - Creativity score

Fluency_Score – Fluency score

Appendix 2: Correlational Matrix Plot
Fluency score, creativity score and Total CAQ

Plot



Appendix 3: Descriptives
Descriptives

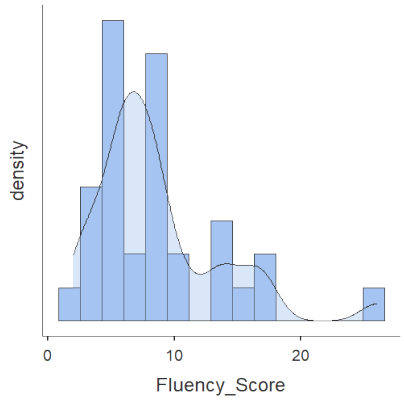
Descriptives

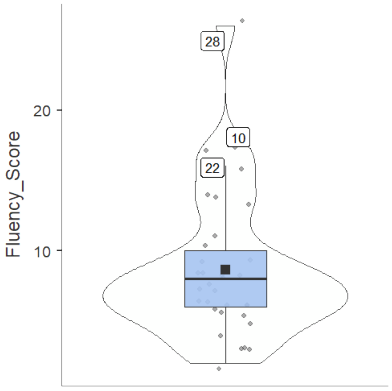
Descriptives

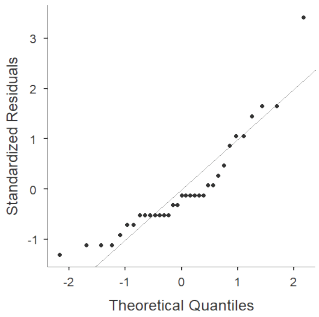
	Fluency_Score	FluencyZScore	creative_score	CreativityZScore	CAQTotal	CAQTotalLog
N	33	33	33	33	33	33
Missing	0	0	0	0	0	0
Mean	8.64	-4.80e−17	2.03	2.10e-17	18.5	1.13
Std. error mean	0.883	0.174	0.294	0.174	3.27	0.0582
Median	8	-0.125	2	-0.0180	13	1.11
Standard deviation	5.07	1.000	1.69	1.000	18.8	0.334
Minimum	2	-1.31	0	-1.20	4	0.602
Maximum	26	3.42	6	2.35	100	2.00
Skewness	1.54	1.54	0.907	0.907	2.93	0.474
Std. error skewness	0.409	0.409	0.409	0.409	0.409	0.409
Kurtosis	3.06	3.06	0.348	0.348	10.6	0.385
Std. error kurtosis	0.798	0.798	0.798	0.798	0.798	0.798
Shapiro-Wilk W	0.865	0.865	0.889	0.889	0.664	0.949
Shapiro-Wilk p	< .001	< .001	0.003	0.003	< .001	0.126

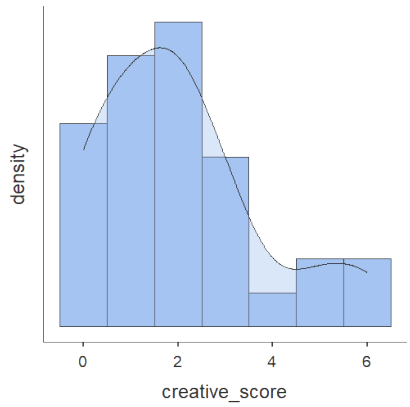
Appendix 4: PLOTS
Plots

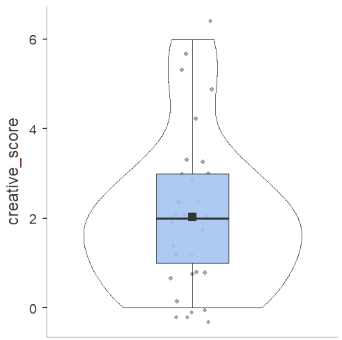
Plots

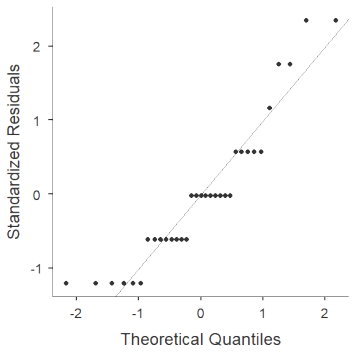


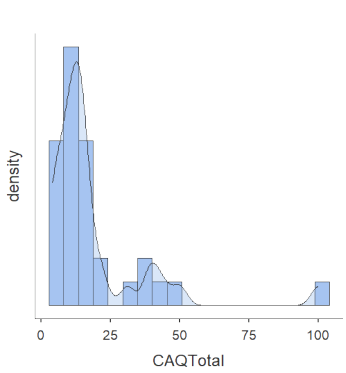


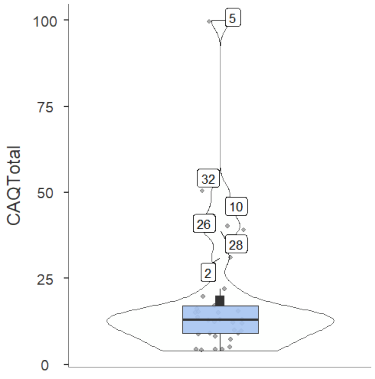


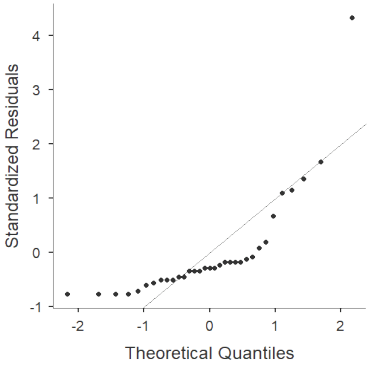


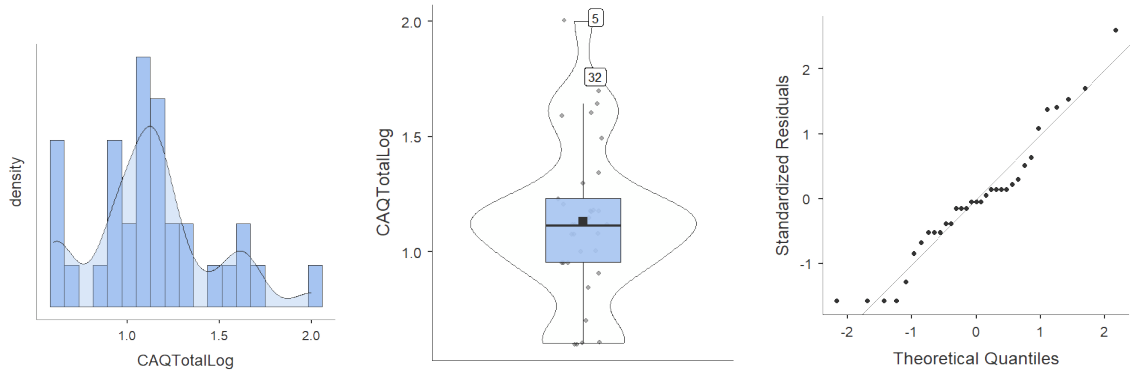












Appendix 5: Correlational matrix CAQ Total Log

A log was computed for the CAQ total score as the data was not normally distributed and it was found that the total CAQ log scores were significantly correlated with the creativity scores as well.

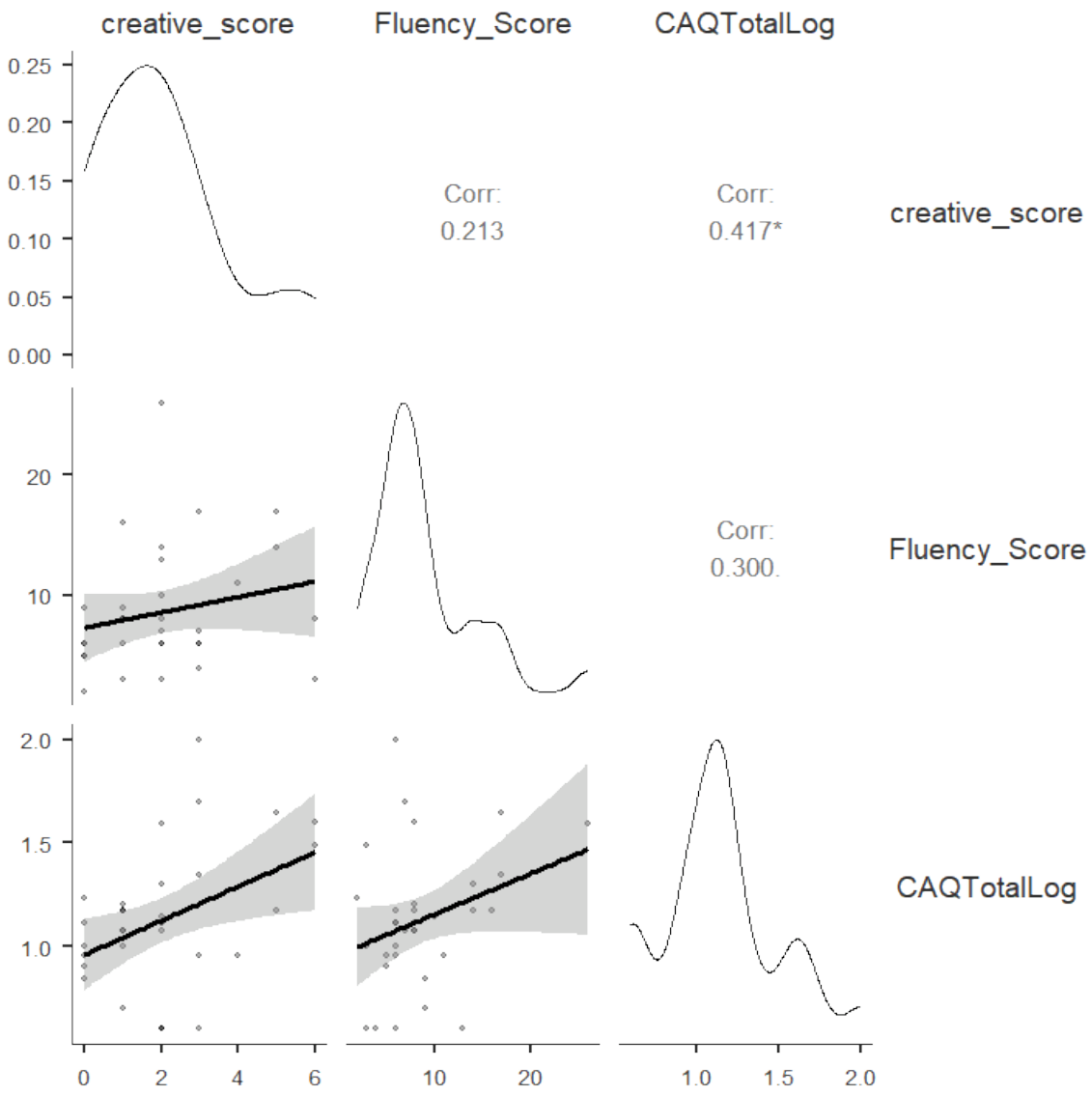
Correlational matrix

Correlation Matrix

		creative_score	Fluency_Score	CAQTotalLog
creative_score	Pearson's r	—		
	df	—		
	p-value	—		
	Spearman's rho	—		
	df	—		
	p-value	—		
Fluency_Score	Pearson's r	0.213	—	
	df	31	—	
	p-value	0.234	—	
	Spearman's rho	0.253	—	
	df	31	—	
	p-value	0.155	—	
CAQTotalLog	Pearson's r	0.417 *	0.300	—
	df	31	31	—
	p-value	0.016	0.090	—
	Spearman's rho	0.350 *	0.283	—
	df	31	31	—
	p-value	0.046	0.110	—

Note. * p < .05, ** p < .01, *** p < .001

Plot


creative_score
Fluency_Score
CAQTotalLog
0.25
0.20
0.15
0.10
0.05
0.00
Corr:
0.213
Corr:
0.417*
creative_score
20
10
Corr:
0.300.
Fluency_Score
2.0
1.5
1.0
CAQTotalLog
0
2
4
6
10
20
1.0
1.5
2.0