Reliability and Validity Analysis of the Diet-Quality Index (DQI) Among New York University Students

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Introduction & Aims

Dietary habits are closely linked to physical and mental health, particularly among university students. Many students follow poor dietary patterns, including irregular meal timing, high consumption of processed foods, and inadequate intake of fruits and vegetables. These behaviors are associated with increased risks of obesity, chronic diseases, and mental health issues like depression and anxiety. Studies have shown that diets rich in whole foods, such as the Mediterranean diet, are linked to better mental health, while diets high in processed foods correlate with worse outcomes (Jacka et al., 2017; Patterson et al., 2020).

The Diet-Quality Index (DQI), derived from the KomPAN questionnaire, is a tool designed to measure dietary habits by categorizing foods as healthy or unhealthy. However, its psychometric properties, including reliability and validity, have not been extensively examined in university populations. This study aims to evaluate the psychometric properties of the DQI among students at New York University and identify potential areas for improvement.

We hypothesize that the DQI has high internal consistency, with a Cronbach's Alpha greater than 0.8, and demonstrates acceptable validity across face, content, criterion, and construct dimensions. To test this, we will analyze internal consistency using Cronbach's Alpha, assess validity through participant feedback and correlational analyses, and perform exploratory and confirmatory factor analyses to evaluate the underlying structure of the DQI. This study seeks to establish the reliability and validity of the DQI and enhance its applicability for assessing dietary habits in university populations.

Instrument Description

The Diet-Quality Index (DQI), derived from the KomPAN questionnaire, assesses dietary habits through 24 items categorized into two indices: the pro-healthy Dietary Index (pHDI) and the non-healthy Dietary Index (nHDI). The pHDI includes items such as fruits, vegetables, and legumes, while the nHDI encompasses foods like sweetened beverages, red meat, and processed snacks. Each item is scored based on its frequency of consumption, ranging from 0 ("never") to 6 ("daily"). The DQI is calculated as the difference between pHDI and nHDI, resulting in a continuous measure where higher scores indicate healthier dietary patterns.

In this study, the DQI demonstrated strong internal consistency, with a Cronbach's Alpha of 0.8259. Removing certain items, such as "Frequency of consuming sweetened beverages" or "Frequency of consuming red meat," slightly increased the value to 0.8318. However, all items were retained to preserve content validity and the questionnaire's comprehensive scope.

Face validity was supported by participant feedback, where most respondents affirmed that the items reflected their dietary habits. Researchers also reviewed the items independently, agreeing that the questionnaire aligned with its intended purpose. Content validity was further supported by the KomPAN questionnaire's development process, which involved expert input to ensure that all key aspects of dietary behaviors were represented (Jezewska-Zychowicz et al., 2020).

Criterion validity, assessed using physical activity as a proxy for health-related behaviors, yielded a weak correlation (0.2147). This suggests that physical activity may not be an ideal gold-standard measure for dietary habits, reflecting a limitation in the criterion rather than the questionnaire itself. Construct validity was supported by examining the relationship between the DQI and meal timing regularity, which showed a weak correlation ($r = 0.0638$). This finding supports the questionnaire’s divergent validity, as dietary quality is conceptually distinct from eating schedules.

Exploratory factor analysis identified six latent factors, reflecting the complexity of dietary patterns. Some items aligned with predefined healthy or unhealthy categories, but others loaded onto factors that suggested more nuanced groupings. Confirmatory factor analysis partially supported these categories but indicated that the current structure could be refined to better capture the relationships among items.

Sample

The dataset for this study consists of responses from 50 New York University students who participated in a survey assessing dietary habits, lifestyle factors, and mental health. Participants were recruited through convenience sampling, utilizing email invitations and social media announcements. This approach ensured rapid data collection but may introduce selection bias, as the sample may not fully represent the broader student population.

The participants ranged in age from 18 to 26, with a majority identifying as Asian, reflecting the demographic composition of the convenience sample. Gender distribution included 58% males, 40% females, and 2% non-binary individuals. Dietary habits were categorized into three groups: pro-healthy, normal, and non-healthy, with 18% reporting pro-healthy diets, 74% reporting normal diets, and 8% reporting non-healthy diets. Other variables included sleep duration, with most participants reporting 7–9 hours of sleep per night, and smoking habits, with 87.76% indicating they had never smoked. Weight categories were distributed as 41.38% light, 41.38% normal, and 17.24% heavy.

Two additional variables were included in this analysis. The first was meal timing regularity, a categorical variable with responses indicating whether participants consistently consumed meals at regular times ("yes" or "no"). The second was weekly physical activity frequency, another categorical variable with three levels: low (0–1 days per week), moderate (2–4 days per week), and high (5 or more days per week). These variables were used to assess construct and criterion validity of the Diet-Quality Index (DQI).

This sample provides a foundation for evaluating the psychometric properties of the DQI. However, its representativeness is limited by the small size and demographic homogeneity. Future studies should aim to increase the sample size and recruit a more diverse group of participants to enhance the generalizability of findings.

Methods

Reliability

The items regarding dietary habits suggested by the KomPAN questionnaire are unstandardized, and items with larger variance are expected to have a bigger impact on reliability. Therefore, Cronbach's Alpha will be used to assess the reliability of the internal consistency of this project.

Validity

The validity of the KomPAN questionnaire will be evaluated through face validity, content validity, criterion validity, and construct validity.

Face validity examines whether the questions appear to measure dietary habits. Therefore, survey participants were asked whether they think these questions precisely measure their dietary habits, and researchers will also ask themselves the same question to assess the face validity of the questionnaire.

Content validity refers to whether these items in the questionnaire adequately reflect the dietary habits. To assess the content validity, researchers will discuss whether additional questions could be included in the questionnaire for a more comprehensive assessment of dietary habits.

Criterion validity measures whether the item in the KomPAN questionnaire is associated with some criterion or “gold standard.” The survey participants were not asked to do another “gold standard” survey on health dietary, the best “gold standard” variable from the existing questionnaire that we assume is the physical activity. It has been identified by researchers that physical activity acts as a behavior that may lead to a healthier diet and regulates eating behaviors. (Urbaniak et al., 2023) Therefore, the correlation between dietary habits and physical activities will be examined to assess the criterion validation in this study.

Construct validity refers to the expectation that items in the study correlate with similar constructs but do not represent the same construct, as well as uncorrelated with unrelated constructs. Although consuming food at a regular time has some association with the potential to decrease the risk of obesity, (Patterson et al., 2020) it is reasonable to assume that dietary habits have little correlation to the schedule and frequency of food consumption. Therefore, construct validation will be evaluated by the correlation between DQI and whether participants consume meals at regular times.

Factor Analysis

In this study, both exploratory and confirmatory factor analysis will be performed to understand the underlying construct of the DQI index.

For the exploratory factor analysis, this study will test if the factors needed to explain the DQI index are consistent with the initial groups of healthy and unhealthy foods. Principal axis factoring will be utilized to identify latent factors that explain the shared variance between items, as well as focusing on the common variance rather than the unique variance. The number of factors will be chosen by the elbow rule which equals the number of eigenvalues that are greater than one. Orthogonal factor rotation will be implemented to strengthen the relationship between items and factors since items are assumed to be independent of each other. The analysis will focus on the factors with a maximum loading greater than 0.6.

The confirmatory factor analysis will be utilized to confirm the particular pattern of relationships based on prior theory, in this case, the two groups of healthy and unhealthy foods. To be specific, a two-factor structural equation model will be performed to test if the two factors identify the underlying construct of the items. All analyses in this study will be performed using STATA 18.

Results

Reliability

The Cronbach's Alpha in this sample is 0.8259 for the 24 questions in the questionnaire, which shows good internal consistency (greater than 0.8). The result also shows that removing the questions "Frequency of consuming white rice, white pasta, fine-ground groats, e.g. semolina, couscous", "Frequency of consuming red meat, e.g. pork, beef, veal, lamb, game", and "Frequency of consuming sweetened carbonated or still drinks such as Coca-Cola, Pepsi, Sprite, Fanta, lemonade" can increase the Cronbach's Alpha to 0.8306, 0.8263, and 0.8318 respectively.

Validity

This study believes that the questionnaire contains an extensive list of possible questions that can examine dietary habits. In addition, most of the survey respondents believe this questionnaire well assesses their dietary habits, though few participants think the survey is too long. Therefore, it shows that this questionnaire has acceptable face validity.

In addition, another paper shows that 10 experts (8 persons who had experience in performing qualitative studies and making tools as well as 3 nutritionists) believe that the original KomPAN questionnaire captures all possible items regarding dietary habits. (Hébert et al., 2022) Therefore, combining the results, the questionnaire is concluded to have excellent content validity.

The empirical correlation (0.2147) suggests that there is a weak association between dietary habits and physical activities. This suggests that the study might have violated the rule of criteria validity. However, it may be due to the fact that physical activity is not an ideal "gold standard" variable that measures the dietary habit, and the sample size is small.

The association between dietary DQI index and frequency of food consumption is also weak (correlation = 0.0638). This weak correlation indicates that the questionnaire has excellent divergent validity as the dietary habit is not expected to correlate with the frequency of food consumption.

<u>Factor analysis</u>

In the exploratory factor analysis, the number of factors is chosen to be six according to the elbow rule. After conducting orthogonal factor rotation, 11 factors have at least one loading greater than 0.6, which suggests that more nuanced factors emerged after rotation. This also suggests that some factors may be more specific or subtle, and foods can not simply be categorized into “healthy” and “unhealthy” groups.

In the confirmatory factor analysis, a structural equation modeling was implemented according to the pre-defined groups of “healthy” and “unhealthy” foods. The variance of “healthy” food is 0.0018, and the variance of “unhealthy” foods is 0.0076, which indicates a small amount of variation in the latent variables. The covariance between the two groups is 0.0016, which is not statistically significant ($p = 0.371$). The Likelihood Ratio test compares the fitted model to a saturated model (a model with all possible parameters estimated). The test statistic is chi2(251) = 509.68, with a p-value less than 0.0001. This indicates that the fitted model is significantly different from the saturated model, suggesting that the model may not be fully capturing the relationships in the sample.

Discussions

The study shows that the survey adapted from the KomPAN questionnaire has good reliability (Cronbach's Alpha = 0.8259). Even though removing some of the questions can increase Cronbach's Alpha up to 0.8318, the changes are small. Therefore, to preserve the content validity, this study does not suggest removing any items regarding dietary habits from the KomPAN questionnaire to improve reliability. In addition, although this study did not perform exact alternative test forms, randomizing the sequence of two groups of food also ensures reliability where participants can not tell which food is healthy or unhealthy directly.

This study also shows that the survey has excellent validity through face validity, content validity, and construct validity. Even though the correlation between dietary habits and physical activity is not strong, it might be due to the inadequate "gold standard" variable. Therefore, there is not enough evidence to conclude that the question lacks good criterion validity.

Combining the result from the exploratory and confirmatory factor analysis, this study suggests that the 24 questions can not be simply categorized into two groups with labels "healthy" and "unhealthy". Nevertheless, items with great contributions to each factor loading in the EFA are consistent with the initial groups. For example, only questions 7, 8, and 24 have loadings greater than 0.6 in Factor 1 which are all in the pre-defined "unhealthy" group, only questions 14 and 15 have loadings greater than 0.6 in Factor 2 which are both in the pre-defined "unhealthy" group, and only questions 11 and 12 have loadings greater than 0.6 in Factor 2 which are both in the pre-defined "healthy" group. This indicates that the items can identify and distinguish healthy and unhealthy dietary habits from participants.

There are several limitations in the study. The sample size is only 50 which may introduce significant random error and affect the reliability and validity of the study. The participants are all NYU Asian students, which may not represent the whole population. This will also introduce the cultural differences where a few Asian participants said they were not able to fully understand some categories of food, which might have affected the reliability and validity.

In future research, it is suggested to increase the sample size and include more heterogeneous samples. More questions can be added to further examine criteria and construct validity, such as BMI, health condition, etc. Furthermore, researchers can consult more experts to include more categories such as “semi-healthy”, “neutral”, and “semi-unhealthy” and then conduct factor analysis to understand the underlying construct better.

Conclusion

Overall, this study illustrates the excellent reliability and validity of the DQI index, as well as suggesting almost no redundancy of the initial items. Thus, it is recommended that other researchers use the KomPAN questionnaire to identify dietary habits by the Diet-Quality Index (DQI) for a larger and more heterogeneous sample.

Reference

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Appendix A - Tables and Figures

Table 1: Frequency Table for Questions of Dietary Habits								
No.	**Food**	**Pre-defined Group**	**Never**	**1-3 times a month**	**Once a week**	**Few times a week**	**Once a day**	**Few times a day**
1	white bread and bakery products	Non-healthy	6	7	15	19	13	0
2	wholemeal (brown) bread/bread rolls	Pro-healthy	12	16	6	15	1	0
3	white rice, white pasta, fine-ground groats	Non-healthy	1	5	4	22	12	6
4	buckwheat, oats, wholegrain pasta or other coarse-ground groats	Pro-healthy	9	19	11	8	2	1
5	fast foods	Non-healthy	2	9	11	24	3	1
6	fried foods	Non-healthy	0	12	10	23	4	1
7	butter	Non-healthy	11	23	6	8	2	0
8	lard	Non-healthy	21	16	4	7	2	0
9	milk	Pro-healthy	4	7	9	16	10	4
10	fermented milk drinks	Pro-healthy	6	15	10	11	7	1
11	fresh cheese curd products	Pro-healthy	11	21	8	7	2	1
12	cheese	Non-healthy	13	15	11	8	3	0
13	cured meat, smoked sausages, hot-dogs	Non-healthy	4	16	17	10	3	0
14	red meat	Non-healthy	0	0	4	21	16	9
15	white meat	Pro-healthy	1	1	4	27	13	4
16	fish	Pro-healthy	2	16	10	20	1	1
17	legumes-based foods	Pro-healthy	3	15	15	10	7	0
18	fruit	Pro-healthy	0	5	12	17	15	1
19	vegetables	Pro-healthy	0	1	2	22	19	6
20	sweets	Non-healthy	1	14	15	11	8	1
21	tinned (jar) meats	Non-healthy	23	15	7	3	2	0
22	sweetened carbonated or still	Non-healthy	3	10	8	20	6	3

Table 1: Frequency Table for Questions of Dietary Habits

	drinks							
23	energy drinks	Non-healthy	20	17	6	5	2	0
24	alcoholic beverages	Non-healthy	11	23	9	6	1	0

Table 2: Frequency Table for Questions of Consuming Meals

Variable	No	Yes, but only some of them	Yes, all of them
Consume meals at regular time	6	28	16

Table 3: Frequency Table for Questions of Exercising

Variable	Don't know / Prefer not to say	Less than 30 minutes	30 minutes to 1 hour	1 hour to 2 hours	More than 2 hours
How often do you exercise every week	2	19	14	10	5

Figure 1: Density Plot of DQI, pHDI, nHDI

DQI	pHDI	nHDI

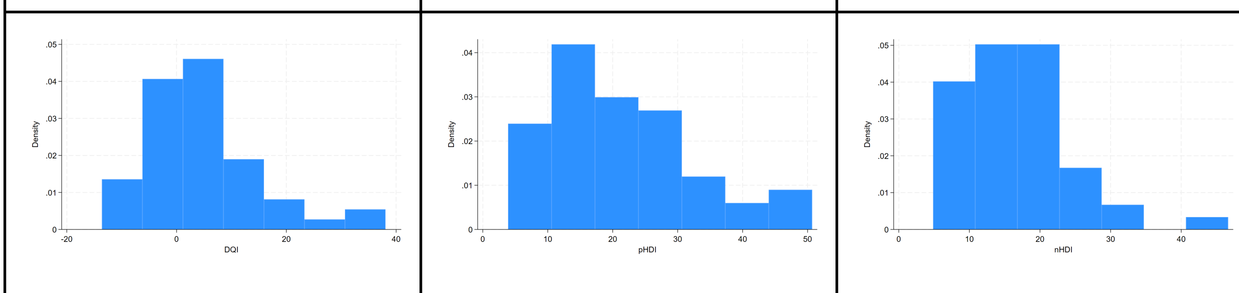

Figure 2: Eigenvalue in Factor Analysis

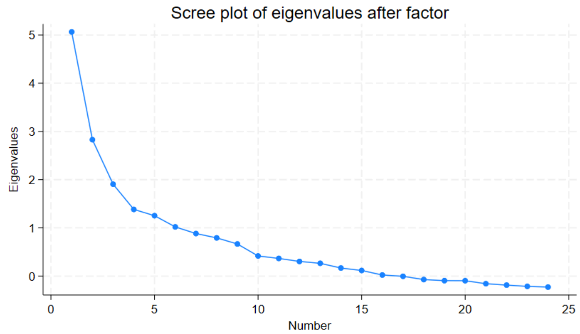

Figure 3: Output of Exploratory Factor Analysis

Rotated factor loadings (pattern matrix) and unique variances

Variable	Factor1	Factor2	Factor3	Factor4	Factor5	Factor6	Factor7	Factor8	Factor9	Factor10	Factor11
Q1	0.1641	0.1102	0.2719	-0.0995	0.1321	0.2293	0.0458	0.1359	0.0460	0.7244	-0.0142
Q2	0.0249	0.0246	0.0993	0.1394	0.0250	0.1240	0.1012	0.0397	0.8243	0.0231	-0.0340
Q3	0.0707	0.2254	-0.2418	-0.1157	0.4528	0.1446	-0.2141	-0.0427	0.2432	-0.2564	0.3769
Q4	0.0433	0.0261	0.1054	0.8836	0.0716	-0.0125	0.0274	0.0358	0.0850	-0.0631	-0.0520
Q5	0.1739	0.1411	-0.0193	0.5483	0.1979	-0.1249	0.1967	-0.1622	0.0542	-0.0373	0.2572
Q6	0.2579	0.1160	-0.0851	0.2611	-0.0401	0.0024	0.6330	-0.0596	0.1089	0.0414	0.1094
Q7	0.7469	-0.0950	0.2984	-0.0453	0.2703	-0.0634	-0.0138	-0.1084	0.1933	0.1197	-0.0288
Q8	0.7692	0.0258	0.0720	0.1421	0.0320	0.2709	0.1972	0.0728	0.0012	0.0943	-0.0116
Q9	-0.0087	0.0977	0.4423	-0.0626	0.1036	0.4346	-0.1538	-0.0858	0.0436	0.1771	0.2179
Q10	0.1352	0.2197	0.1658	-0.0800	0.0163	0.7302	0.0967	0.1763	0.2158	0.1902	-0.1444
Q11	0.1993	0.0142	0.8537	0.0319	0.1341	0.1322	-0.0525	0.0635	0.0568	0.1113	-0.0405
Q12	0.3396	0.2316	0.6436	0.4514	0.0434	0.0373	0.1370	-0.1232	0.0723	0.1605	0.0042
Q13	0.1458	-0.0155	0.0264	0.0194	0.1484	0.0943	0.6073	0.1952	0.1599	0.0103	-0.0633
Q14	-0.0348	0.8260	0.0118	0.1088	0.1128	0.0111	0.0461	-0.0112	0.0020	-0.0884	0.0651
Q15	-0.0242	0.7614	0.1018	-0.0211	0.1623	0.2316	0.0341	0.1249	0.0705	0.2605	0.1264
Q16	0.0952	0.3515	0.2350	0.0340	0.4298	0.0707	-0.0948	0.2120	-0.0872	0.3698	-0.1067
Q17	0.1662	0.1989	0.1710	0.1584	0.8337	0.0342	0.0854	0.0737	0.0138	0.1163	0.0233
Q18	0.0778	0.1068	-0.0366	-0.0452	0.0743	0.1469	0.0977	0.7538	0.0697	0.1372	-0.0505
Q19	-0.1313	0.4379	0.2010	0.1561	0.2101	0.4225	-0.2372	0.4033	-0.1322	0.0429	-0.0131
Q20	-0.0029	-0.0084	0.0622	-0.0685	0.0906	-0.0504	0.0737	0.0995	0.1086	0.0667	0.1008
Q21	0.4486	0.0464	0.1473	0.3106	0.3037	-0.0540	0.1682	-0.1163	0.0844	-0.0489	-0.0955
Q22	0.0206	0.2026	-0.0034	0.0020	0.0197	-0.1439	0.0652	-0.0540	-0.0958	-0.0030	0.6847
Q23	0.4878	-0.0285	0.1242	-0.0857	0.2547	-0.0662	0.3711	0.2156	-0.0962	0.0858	0.0279
Q24	0.6334	-0.0513	0.1929	0.1671	-0.0773	-0.0811	0.0426	0.1790	-0.2373	-0.0657	0.1648

Figure 4: Output of Confirmatory Factor Analysis

Structural equation model Number of obs = **50**
Estimation method: **ml**

Log likelihood = **-298.93899**

(1) **[Q2]pro = 1**
(2) **[Q1]non = 1**

	Coefficient	OIM std. err.	z	P>|z|	[95% conf.	interval]
Measurement						
Q2						
pro	1	(constrained)				
_cons	.206	.0334867	6.15	0.000	.1403672	.2716328
Q4						
pro	1.431186	1.736418	0.82	0.410	-1.972131	4.834503
_cons	.2136	.049001	4.36	0.000	.1175598	.3096402
Q9						
pro	5.423432	5.011795	1.08	0.279	-4.399505	15.24637
_cons	.5536	.0771439	7.18	0.000	.4024008	.7047992
Q10						
pro	5.35165	4.724848	1.13	0.257	-3.908883	14.61218
_cons	.336	.0578107	5.81	0.000	.2226931	.4493069
Q11						
pro	4.314453	3.869784	1.11	0.265	-3.270185	11.89909
_cons	.1976	.0491126	4.02	0.000	.1013412	.2938588
Q15						
pro	7.252878	6.462258	1.12	0.262	-5.412915	19.91867
_cons	.7024	.0668243	10.51	0.000	.5714269	.8333731
Q16						
pro	5.548912	4.986081	1.11	0.266	-4.223627	15.32145
_cons	.3072	.0470532	6.53	0.000	.2149775	.3994225
Q17						
pro	4.550285	4.111224	1.11	0.268	-3.507567	12.60814
_cons	.3	.0462515	6.49	0.000	.2093488	.3906512
Q18						
pro	3.714122	3.509681	1.06	0.290	-3.164726	10.59297
_cons	.5496	.0579662	9.48	0.000	.4359884	.6632116
Q19						
pro	7.954062	7.160011	1.11	0.267	-6.079301	21.98743
_cons	.8468	.071244	11.89	0.000	.7071643	.9864357
Q1						
non	1	(constrained)				
_cons	.3004	.037721	7.96	0.000	.2264681	.3743319
Q3						
non	-.0704827	.9973554	-0.07	0.944	-2.025263	1.884298
_cons	.7172	.0796934	9.00	0.000	.5610037	.8733963
Q5						
non	1.913628	1.082195	1.77	0.077	-.2074356	4.034692
_cons	.3816	.0488552	7.81	0.000	.2858456	.4773544
Q6						
non	1.725364	.985079	1.75	0.080	-.2053549	3.656084
_cons	.3924	.050161	7.82	0.000	.2940863	.4907137
Q7						
non	1.928214	.9206526	2.09	0.036	.1237678	3.73266
_cons	.1644	.0337581	4.87	0.000	.0982352	.2305648
Q8						
non	1.903435	.9148638	2.08	0.037	.1103351	3.696535
_cons	.1404	.0340611	4.12	0.000	.0736415	.2071585
Q12						
non	2.06371	.9940735	2.08	0.038	.1153622	4.012059
_cons	.1888	.0373488	5.06	0.000	.1155977	.2620023
Q13						
non	1.175953	.6878438	1.71	0.087	-.1721956	2.524102
_cons	.2268	.0364356	6.22	0.000	.1553875	.2982125

Figure 4: Output of Confirmatory Factor Analysis

Q14						
non	.9014709	1.113791	0.81	0.418	-1.281519	3.08446
_cons	.9012	.081781	11.02	0.000	.7409122	1.061488
Q20						
non	.3686563	.7314235	0.50	0.614	-1.064907	1.80222
_cons	.3688	.0575977	6.40	0.000	.2559106	.4816894
Q21						
non	1.785853	.8891707	2.01	0.045	.0431109	3.528596
_cons	.1076	.0307396	3.50	0.000	.0473514	.1678486
Q22						
non	.3966893	.8860262	0.45	0.654	-1.33989	2.133269
_cons	.4744	.0691087	6.86	0.000	.3389494	.6098506
Q23						
non	1.529709	.7698057	1.99	0.047	.0209179	3.038501
_cons	.1272	.0323716	3.93	0.000	.0637528	.1906472
Q24						
non	1.331408	.6787959	1.96	0.050	.0009924	2.661823
_cons	.1328	.0274037	4.85	0.000	.0790897	.1865103
var(e.Q2)	.0542488	.010946			.0365292	.0805639
var(e.Q4)	.1163289	.0234586			.0783495	.1727185
var(e.Q9)	.244051	.0519888			.1607511	.3705161
var(e.Q10)	.115003	.0266605			.0730096	.1811499
var(e.Q11)	.0867395	.0194484			.0558938	.1346077
var(e.Q15)	.1275787	.0314638			.0786779	.2068728
var(e.Q16)	.0546875	.0149635			.0319877	.0934957
var(e.Q17)	.0692941	.0166996			.0432076	.1111303
var(e.Q18)	.1429091	.0298964			.0948395	.2153428
var(e.Q19)	.1386928	.0362129			.0831389	.2313682
var(e.Q1)	.0635623	.0130714			.0424769	.0951146
var(e.Q3)	.3175145	.0635043			.2145455	.4699024
var(e.Q5)	.0915782	.0199134			.0598	.1402436
var(e.Q6)	.103237	.0215868			.0685251	.1555326
var(e.Q7)	.0287925	.0071819			.0176587	.0469463
var(e.Q8)	.0305396	.0075482			.0188139	.0495733
var(e.Q12)	.0374577	.0091293			.0232319	.0603945
var(e.Q13)	.0558936	.0115934			.0372226	.08393
var(e.Q14)	.3282455	.0659346			.2214206	.4866082
var(e.Q20)	.1648442	.0330055			.1113381	.2440638
var(e.Q21)	.0230668	.0059121			.0139579	.0381201
var(e.Q22)	.2376076	.0475672			.1604931	.3517745
var(e.Q23)	.0346554	.0077305			.0223818	.0536595
var(e.Q24)	.0241088	.0053675			.0155836	.037298
var(pro)	.0018192	.0031817			.000059	.0560545
var(non)	.0075815	.0070786			.0012162	.0472597
cov(pro,non)	.0015704	.0017546	0.90	0.371	-.0018686	.0050094

LR test of model vs. saturated: chi2(251) = 509.68 Prob > chi2 = 0.0000

Appendix B - STATA Code

```
clear all
use "data.dta", replace

// Cronbach's Alpha
alpha Q1 - Q24, item

// Appling weight according to instruction
foreach var of varlist Q1 - Q24 {
    replace `var' = 0 if `var' == 1
    replace `var' = 0.06 if `var' == 2
    replace `var' = 0.14 if `var' == 3
    replace `var' = 0.5 if `var' == 4
    replace `var' = 1 if `var' == 5
    replace `var' = 2 if `var' == 6
}

// Calculate pHDI and nHDI
egen pHDI = rowtotal(Q2 Q4 Q9 Q10 Q11 Q15 Q16 Q17 Q18 Q19)
egen nHDI = rowtotal(Q1 Q3 Q5 Q6 Q7 Q8 Q12 Q13 Q14 Q20 Q21 Q22 Q23 Q24)

// Standardizing
replace pHDI = (pHDI * 100) / 20
replace nHDI = (nHDI * 100) / 28

// Calculate DQI
gen DQI = pHDI - nHDI

// Criteria Validity
anova DQI exercise

// Construct Validity
anova DQI regular

// Exploratory Factor Analysis
factor Q1 - Q24
rotate
screeplot

// Confirmatory Factor Analysis
sem (pro-> Q2 Q4 Q9 Q10 Q11 Q15 Q16 Q17 Q18 Q19) (non-> Q1 Q3 Q5 Q6 Q7 Q8 Q12 Q13
Q14 Q20 Q21 Q22 Q23 Q24), nocapslatent latent(pro non)
```