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# Rasch model: Student Perception on Organisational Learning, Ethical Leadership, Government Support and Corporate Governance Influence the Corporate Social Innovation

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## Abstract

This study investigates the factors influencing corporate social innovation (CSI) in Malaysian small and medium enterprises (SMEs) by using student perceptions. Using Rasch model analysis, the study aims to validate the measurement instrument assessing four key constructs: organisational learning, ethical leadership, government support, and corporate governance. Data from 25 student respondents were analyzed for person and item reliability, model fit, and unidimensionality. The results showed strong person reliability (0.89) and acceptable item reliability (0.71), with most items fitting the Rasch model expectations. One item (F2) showed significant misfit and requires revision. The Wright Map highlighted a need for more challenging items for high-ability respondents and better-aligned items for lower-ability participants. The scale demonstrated acceptable unidimensionality (71.3%), supporting its use for measuring perceptions related to CSI drivers. These findings confirm the instrument's validity and suggest improvements for future application.

**Keywords:** *Organizational Learning, Ethical Leadership, Government Support, Corporate Governance, Corporate Social Innovation*

## Introduction

Social innovation has experienced tremendous progress in the last ten years, mirroring growing global interest in the application of innovative, collaborative, and community-driven methods for addressing complex social issues (Georgios & Barraí, 2023; Mohammad, 2025; Yaseen et al., 2023). Whereas previously targeting efficiency and enhanced service provision, recent scholarship suggests a transition towards more profound, change-making paradigms that take into account power relationships and local systems of knowledge (Biridlo'i Robby et al., 2024; Buck et al., 2023; Pearce & van Knippenberg, 2024; Price et al., 2023; Mohammad et al., 2025a). These advances highlight the need for knowing the theories of social innovation, especially as the world is gravitating towards inclusive, equitable, and sustainable development agendas (Phillips et al., 2024; Gegenhuber & Mair, 2024; Mohammad et al., 2025b; Hujran et al., 2023).

In the midst of this global change, corporate social innovation, or CSI, emerged as a key paradigm, wherein companies are required to generate social and environmental value alongside financial returns (Bradaˇ, 2020; Saka-Helmhout et al., 2021; Mohammad et al., 2025c; Al-Rahmi et al., 2023). Such adjustment is seen in increasing inclusion of sustainability reporting, ESG practices, and mission-based strategies to advance global initiatives such as the UN's SDGs (Chopra et al., 2024; Husainy et al., 2024). Small and medium-sized enterprises-these are the groups of companies that best represent regional economic ecosystems-are themselves being influenced as much by multinational corporations' adjustment across industries and geographies. Globally, initiatives such as the United Nations

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Sustainable Development Goals (SDGs) and rising concerns for climate change, equality, and good governance have pushed corporations to do more than normal corporate social responsibility (CSR) (Husainy et al., 2024; Mohammad et al., 2025d).

Corporate social innovation, or the establishment and implementation of new and effective solutions to environmental and social challenges, is being viewed as a platform on which business can create economic and social value (Mustapha et al., 2021). In Malaysia, corporate social investing (CSI) is becoming more aligned with national plans such as the Shared Prosperity Vision 2030 and the 12th Malaysia Plan (Yadegaridehkordi et al., 2023; Mustapha et al., 2024; Mohammad et al., 2025e; Lotfinezhad & Tahmasebpoor 2025; Shah et al., 2024; Kahi, 2025). SMEs comprise more than 97% of the entire company establishments in Malaysia and are considered to be the drivers of social innovation and inclusive growth. The government has thus promulgated various regulations and incentives for encouraging SMEs to adopt sustainable practices. Integrating social innovation into their operations is central to realizing balance between social welfare and economic development, and domestic SMEs are viewed as drivers of sustainable development particularly as the nation strives to attain inclusive development objectives through visions like the Shared Prosperity Vision 2030 and the 12th Malaysia Plan (Yadegaridehkordi et al., 2023; Mohammad et al., 2025). The government has put in place various incentives, grants, and aid programs to motivate SMEs towards sustainable practices. However, the extent to which the companies are able to adopt CSI depends not just on external aid but also on internal organisational factors such as leadership, learning culture, and governance structures (Mustapha et al., 2024; Mohammad et al., 2025g).

Understanding the determinants of CSI perceptions by future leaders is significant in shaping a business culture that is sustainable and responsible (Mustapha et al., 2024; Fauzi, 2022; Mohammad et al., 2025h). Although there has been research on the role of organizational learning, ethical leadership, government support, and corporate governance towards fostering corporate social responsibility, less emphasis has been given to how these elements cumulatively impact the impression of CSI among Malaysian students. It is important because students are potential future leaders in business and their impressions will determine the direction of corporate practice in the future.

The purpose of this study is to evaluate how students perceive the effects of corporate governance, ethical leadership, government assistance, and organisational learning on CSI in Malaysian SMEs. The measurement tool was validated using the Rasch model, which provides a strong psychometric approach to guarantee the validity and reliability of the results. By emphasising the viewpoints of students, this study adds to the expanding conversation about sustainable business practices and provides information on how awareness and education can influence future corporate behaviour (Vinesh Maran Sivakumaran, 2025).

## Theoretical Framework

In order to comprehend how internal and external factors impact corporate social innovation (CSI) in SMEs, this study is based on the Resource-Based View (RBV) and Stakeholder Theory.

To understand how internal and external conditions influence corporate social innovation (CSI) in small and medium-sized enterprises (SMEs), this study draws on the Resource-Based View (RBV) and Stakeholder Theory. RBV suggests that when a firm's internal resources such as knowledge, leadership, culture, or governance are valuable, rare, inimitable, and non-substitutable, they form the basis for sustained competitive advantage. In this context, ethical leadership and organisational learning function as core capabilities. These enable firms to respond to social needs, integrate ethical considerations into strategic planning, and remain adaptive. For SMEs, which often operate with limited external support or financial slack, making full use of internal strengths becomes a critical step in developing meaningful CSI efforts.

As stakeholder theory explains, it is vital to tend to the needs of all parties beyond mere shareholders involved in a business. This theory supports that corporations, in particular, have a social responsibility to consider the needs of their communities, employees, customers, legislators, and the ecological surroundings. This incorporates governance of the company and aid that the government provides, as both include external frameworks and expectations as guidance to act in a morally and socially responsible way. Socially responsible policy and good governance enable small and medium-sized enterprises SMEs to practice socially innovative policy more to the advancement of society.

## Discussion

The following important questions are the focus of this study: (1) How do corporate governance, ethical leadership, government assistance, and organisational learning affect Malaysian students' opinions of CSI both separately and together? (2) Which of these elements is thought to be most important for encouraging CSI in students? The main goal of this study is to find out how students perceive the contribution of each component to CSI in order to answer these questions. Determining the relative significance of these elements for students in the Malaysian context is another goal.

This study draws on Stakeholder Theory, which emphasises the need for organisations to consider the interests of various parties including society and the environment when making strategic decisions. It also incorporates Social Cognitive Theory, which explains how beliefs and behaviours are shaped by observation, social experience, and context. By combining these two perspectives, the study aims to better understand the factors that shape students' views on corporate social innovation (CSI) and how those views may carry into their future roles as decision-makers.

It is anticipated that this study will contribute significantly in multiple ways. First, it contributes to the scant literature in this field by offering empirical data on the variables influencing Malaysian students' opinions of CSI. Second,xxx s the results can guide the creation of curricula and educational initiatives that encourage students to participate in CSI. Third, the study offers practical insights for companies aiming to build a culture that supports social innovation while engaging with future leaders. Understanding how the next generation views business responsibilities helps organisations align their strategies with emerging expectations. This research contributes to ongoing discussions about sustainable and ethical business practices within the Malaysian context.

### Description

### Person Measurement Analysis

The Rasch model analysis demonstrated strong measurement properties for the participants (N = 25). The mean person measure was 69.68 logits (SD = 19.47), indicating substantial variability in ability levels. High **person reliability (.89)** and a separation index of **2.86** confirmed that the assessment effectively discriminated between individuals of differing abilities. The INFIT (1.13) and OUTFIT (1.03) mean-square statistics aligned closely with the expected value of 1.0, suggesting good model-data fit. Minor deviations in standardized fit statistics (ZSTD: -0.1 to -0.3) indicated negligible misfit. The real root mean square error (RMSE) of 6.44 further supported measurement precision, with a true SD of 18.38, reinforcing the instrument's validity for assessing individual differences.

### Item Calibration Analysis

For the 38 items analyzed, the mean difficulty measure was 50.00 logits (SD = 3.28), reflecting moderate variability in item challenges. **Item reliability (0.71) and separation (1.58)** were acceptable, though slightly lower than person estimates, suggesting room for refinement in difficulty distribution. The INFIT (0.97) and OUTFIT (1.03) statistics indicated excellent adherence to Rasch expectations, with non-significant ZSTD values (-0.2 to -0.1) confirming fit. The real RMSE (1.75) and true SD (2.77) underscored stable item calibration. To optimize measurement, future iterations could include additional items targeting extreme difficulty levels to enhance reliability and separation.

Overall, the Rasch analysis demonstrated **strong person reliability (0.89)** and **acceptable item reliability (0.71)**, with good model-data fit for both persons and items, indicating that the assessment is valid for measuring individual abilities, though slight refinements in item difficulty could further enhance measurement precision.

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>============================================================================<
Time for estimation: 0:0:6.719
Output to C:\Users\user\OneDrive - Universiti Sains Islam Malaysia\Desktop\ZOU188WS.TXT
Project Kak Dyna 190325
------------------------------------------------------------------------------
| Person      38 INPUT      38 MEASURED              INFIT        OUTFIT    |
|           TOTAL     COUNT     MEASURE  REALSE     IMNSQ   ZSTD  OMNSQ   ZSTD|
| MEAN     183.6      25.0       69.68    4.11      1.13    -.1   1.03    -.3|
| P.SD      31.8         .0       19.47    4.95       .83    2.4    .66    2.3|
| REAL RMSE   6.44 TRUE SD   18.38  SEPARATION  2.86  Person RELIABILITY  .89|
|-----------------------------------------------------------------------------|
| Item      25 INPUT      25 MEASURED              INFIT        OUTFIT    |
|           TOTAL     COUNT     MEASURE  REALSE     IMNSQ   ZSTD  OMNSQ   ZSTD|
| MEAN     279.1      38.0       50.00    1.74       .97    -.2   1.03    -.1|
| P.SD      13.2         .0        3.28     .18       .53    1.7    .68    1.9|
| REAL RMSE   1.75 TRUE SD    2.77  SEPARATION  1.58  Item   RELIABILITY  .71|
------------------------------------------------------------------------------
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**Figure 1: Summary Statistic for Persons and Items**

**Determine Misfit Items/Person**

There are means of checking for item quality control in Rasch. Item fit refers to an index that implies the functionality of an item. A misfit item means that the particular item is either too difficult or too easy for the respondent, or the item is not really testing the desired latent trait. Similarly, person fit refers to an index that signifies the responses of an individual. An irregular or erratic response could be a sign of a misfit. According to Fisher (2007), in order to verify for fit and misfit items or persons, the following criteria must be satisfied:

- Point Measure Correlation, **0.4** < x < **0.8**
- Outfit Mean Square (MNSQ), **0.5 < y < 1.5**
- Outfit Z standard (ZSTD), **-2.0 < Z <+2.0**

The Rasch analysis results indicate that most of the 25 test items fit the model reasonably well, though a few show significant misfit. The most problematic item is **F2 (Entry 22)**, which demonstrates severe misfit with inflated infit (MNSQ = 3.12) and outfit (MNSQ = 4.08) statistics, suggesting it does not measure the same construct as the other items. Additionally, its low point-measure correlation (0.51) and fewer exact matches than expected (17.6% vs. 30.8%) further confirm its poor fit. Items **B9 (Entry 4), B6 (Entry 1), and B8 (Entry 3)** also show mild misfit but are less extreme, with infit and outfit statistics slightly above the ideal range (0.7–1.3). These items may need review, but their impact on the overall test is less severe.

The majority of items, particularly those at the bottom of the table (e.g., **C4, C5, C3**), fit the model well, with infit and outfit statistics close to the ideal value of 1.0. Some items slightly underfit (MNSQ < 0.7), but this is generally less concerning than overfit. The overall test shows good person separation (2.86, reliability = 0.89), meaning the test effectively distinguishes between high and low performers. However, item separation is moderate (1.58, reliability = 0.71), suggesting some items may cluster closely in difficulty. To improve measurement precision, **F2 should be removed or revised**, and borderline misfitting items (e.g., B9, B6, B8) should be examined further. The remaining items function well, supporting the test's validity.

TABLE 10.1 Project Kak Dyna 190325 ZOU188WS.TXT Mar 19 2025 12:59
INPUT: 38 Person 25 Item REPORTED: 38 Person 25 Item 9 CATS MINISTEP 5.8.4.0

Person: REAL SEP.: 2.86 REL.: .89 ... Item: REAL SEP.: 1.58 REL.: .71

Item STATISTICS: MISFIT ORDER

| ENTRY NUMBER | TOTAL SCORE | TOTAL COUNT | JMLE MEASURE | MODEL S.E. | INFIT MNSQ | INFIT ZSTD | OUTFIT MNSQ | OUTFIT ZSTD | PTMEASUR-AL CORR. | PTMEASUR-AL EXP. | EXACT MATCH OBS% | EXACT MATCH EXP% | Item |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 22 | 234 | 38 | 60.16 | 1.38 | 3.12 | 5.76 | 4.08 | 7.53 | A .51 | .75 | 17.6 | 30.8 | F2 |
| 4 | 272 | 38 | 52.03 | 1.57 | 1.56 | 1.90 | 1.37 | 1.40 | B .64 | .67 | 29.4 | 37.5 | B9 |
| 1 | 275 | 38 | 51.28 | 1.59 | 1.35 | 1.28 | 1.27 | 1.04 | C .64 | .66 | 41.2 | 38.0 | B6 |
| 3 | 276 | 38 | 51.03 | 1.60 | 1.35 | 1.28 | 1.19 | .79 | D .64 | .66 | 32.4 | 38.3 | B8 |
| 25 | 284 | 38 | 48.88 | 1.68 | 1.01 | .13 | 1.30 | 1.13 | E .64 | .64 | 47.1 | 39.3 | F6 |
| 5 | 261 | 38 | 54.61 | 1.50 | 1.19 | .78 | 1.27 | 1.07 | F .69 | .69 | 32.4 | 34.3 | B10 |
| 13 | 284 | 38 | 48.88 | 1.68 | 1.25 | .93 | 1.21 | .84 | G .60 | .64 | 26.5 | 39.3 | D1 |
| 15 | 292 | 38 | 46.51 | 1.77 | 1.12 | .52 | 1.24 | .90 | H .59 | .61 | 41.2 | 41.0 | D3 |
| 7 | 280 | 38 | 49.98 | 1.64 | .97 | -.03 | 1.03 | .21 | I .65 | .65 | 52.9 | 39.2 | C2 |
| 17 | 293 | 38 | 46.20 | 1.78 | 1.03 | .19 | 1.01 | .11 | J .62 | .61 | 50.0 | 41.0 | D5 |
| 2 | 260 | 38 | 54.83 | 1.49 | .97 | -.01 | .87 | -.46 | K .72 | .70 | 44.1 | 34.4 | B7 |
| 12 | 273 | 38 | 51.78 | 1.58 | .91 | -.26 | .97 | -.03 | L .67 | .67 | 52.9 | 37.6 | C7 |
| 6 | 274 | 38 | 51.53 | 1.59 | .90 | -.32 | .89 | -.36 | M .68 | .67 | 50.0 | 37.9 | C1 |
| 24 | 290 | 38 | 47.13 | 1.74 | .74 | -.93 | .86 | -.44 | l .66 | .62 | 35.3 | 40.0 | F5 |
| 11 | 277 | 38 | 50.77 | 1.61 | .66 | -1.39 | .81 | -.69 | k .69 | .66 | 41.2 | 39.0 | C6 |
| 16 | 293 | 38 | 46.20 | 1.78 | .78 | -.77 | .69 | -1.19 | j .64 | .61 | 44.1 | 41.0 | D4 |
| 18 | 295 | 38 | 45.55 | 1.81 | .59 | -1.63 | .72 | -1.02 | i .65 | .60 | 44.1 | 43.3 | D6 |
| 19 | 289 | 38 | 47.43 | 1.73 | .71 | -1.06 | .70 | -1.14 | h .67 | .62 | 52.9 | 39.8 | D7 |
| 21 | 274 | 38 | 51.53 | 1.59 | .66 | -1.39 | .70 | -1.22 | g .71 | .67 | 47.1 | 37.9 | F1 |
| 14 | 293 | 38 | 46.20 | 1.78 | .67 | -1.23 | .68 | -1.25 | f .68 | .61 | 61.8 | 41.0 | D2 |
| 20 | 285 | 38 | 48.60 | 1.69 | .62 | -1.54 | .63 | -1.53 | e .68 | .64 | 52.9 | 39.2 | D8 |
| 23 | 277 | 38 | 50.77 | 1.61 | .63 | -1.50 | .63 | -1.55 | d .74 | .66 | 61.8 | 39.0 | F4 |
| 8 | 286 | 38 | 48.31 | 1.70 | .60 | -1.61 | .54 | -2.01 | c .69 | .63 | 55.9 | 39.1 | C3 |
| 10 | 273 | 38 | 51.78 | 1.58 | .49 | -2.31 | .53 | -2.16 | b .72 | .67 | 44.1 | 37.6 | C5 |
| 9 | 287 | 38 | 48.02 | 1.71 | .44 | -2.54 | .50 | -2.21 | a .72 | .63 | 70.6 | 39.7 | C4 |
| MEAN | 279.1 | 38.0 | 50.00 | 1.65 | .97 | -.23 | 1.03 | -.09 | | | 45.2 | 38.6 | |
| P.SD | 13.2 | .0 | 3.28 | .10 | .53 | 1.68 | .68 | 1.90 | | | 11.7 | 2.5 | |

**Figure 2: Items Measure**

Figure 3 presents Person Fit Statistics in a Rasch model analysis, listing individuals based on their responses and fit to the model. It evaluates how well each respondent's answers align with the expected Rasch model patterns. The key columns include measure (ability level), infit and outfit mean-square (MNSQ) values, Z-standardized (ZSTD) values, and correlation (PTMEASUR-AL), which indicate response consistency.

From the data, individuals like **P24, P25, and P33** show high ability levels (MEASURE above 65 logits), meaning they answered more difficult items correctly. However, their INFIT and OUTFIT MNSQ values exceed 1.5, indicating unexpected response patterns (possibly guessing, carelessness, or misfitting responses). On the other hand, mid-range participants (e.g., P01, P16, P13) display MNSQ values closer to 1, suggesting they responded in a way that aligns well with the Rasch model. Meanwhile, low-ability individuals (e.g., P04, P37, P30) have the lowest measures (below 50 logits), with some showing negative ZSTD values, indicating overfitting (responses are too predictable or mechanical).

The mean fit values (MNSQ 1.13 INFIT, 1.03 OUTFIT) suggest that, on average, the test responses fit the model well, but some individuals show misfit. To improve the test, further investigation of misfitting persons (e.g., P24, P25, and P33) is necessary potential causes include random guessing, test anxiety, or engagement issues. Additionally, participants with overfit responses (e.g., P04, P37) may require closer examination, as their responses may be too predictable or indicate limited engagement with the test items.

TABLE 6.1 Project Kak Dyna 190325 ZOU281WS.TXT Mar 25 2025 11:41
INPUT: 38 Person 25 Item REPORTED: 38 Person 25 Item 9 CATS MINISTEP 5.8.4.0

Person: REAL SEP.: 2.86 REL.: .89 ... Item: REAL SEP.: 1.58 REL.: .71

Person STATISTICS: MISFIT ORDER

| ENTRY NUMBER | TOTAL SCORE | TOTAL COUNT | JMLE MEASURE | MODEL S.E. | INFIT MNSQ | INFIT ZSTD | OUTFIT MNSQ | OUTFIT ZSTD | PTMEASUR-AL CORR. | PTMEASUR-AL EXP. | EXACT MATCH OBS% | EXACT MATCH EXP% | Person |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 24 | 193 | 25 | 66.83 | 2.08 | 3.67 | 5.52 | 3.01 | 4.55 | A .74 | .33 | 12.0 | 41.7 | P24 |
| 25 | 207 | 25 | 74.43 | 2.64 | 3.19 | 4.40 | 2.26 | 2.98 | B .57 | .27 | 28.0 | 41.1 | P25 |
| 33 | 216 | 25 | 82.77 | 3.57 | 2.85 | 3.40 | 1.78 | 1.78 | C .49 | .21 | 72.0 | 66.8 | P33 |
| 14 | 130 | 25 | 48.80 | 1.48 | 2.33 | 3.51 | 2.24 | 3.32 | D .44 | .42 | 16.0 | 30.5 | P14 |
| 31 | 191 | 25 | 65.98 | 2.03 | 1.78 | 2.25 | 1.97 | 2.66 | E-.26 | .33 | 24.0 | 39.9 | P31 |
| 27 | 206 | 25 | 73.75 | 2.59 | 1.63 | 1.72 | 1.67 | 1.83 | F-.05 | .27 | 24.0 | 40.9 | P27 |
| 11 | 175 | 25 | 60.29 | 1.77 | 1.66 | 2.08 | 1.65 | 2.05 | G .08 | .37 | 32.0 | 31.5 | P11 |
| 1 | 130 | 25 | 48.80 | 1.48 | 1.54 | 1.72 | 1.62 | 1.91 | H .53 | .42 | 36.0 | 30.5 | P01 |
| 15 | 173 | 25 | 59.68 | 1.74 | 1.56 | 1.82 | 1.48 | 1.60 | I .82 | .37 | 8.0 | 31.2 | P15 |
| 23 | 218 | 25 | 85.63 | 4.00 | 1.47 | 1.13 | 1.03 | .20 | J .55 | .19 | 80.0 | 74.2 | P23 |
| 17 | 205 | 25 | 73.09 | 2.53 | 1.41 | 1.24 | 1.09 | .39 | K .65 | .28 | 36.0 | 41.6 | P17 |
| 16 | 174 | 25 | 59.98 | 1.75 | 1.12 | .51 | 1.05 | .27 | L .39 | .37 | 32.0 | 31.5 | P16 |
| 10 | 190 | 25 | 65.57 | 2.01 | 1.10 | .41 | 1.09 | .40 | M-.01 | .34 | 40.0 | 38.5 | P10 |
| 13 | 170 | 25 | 58.78 | 1.71 | 1.09 | .41 | 1.09 | .41 | N .40 | .38 | 44.0 | 31.2 | P13 |
| 29 | 210 | 25 | 76.70 | 2.86 | .93 | -.09 | 1.01 | .15 | O-.14 | .25 | 40.0 | 47.0 | P29 |
| 21 | 200 | 25 | 70.18 | 2.30 | .97 | .01 | .97 | .01 | P .27 | .30 | 48.0 | 43.2 | P21 |
| 26 | 213 | 25 | 79.40 | 3.15 | .91 | -.14 | .89 | -.21 | Q .29 | .23 | 48.0 | 54.6 | P26 |
| 7 | 179 | 25 | 61.57 | 1.82 | .85 | -.48 | .87 | -.40 | q .39 | .36 | 32.0 | 33.6 | P07 |
| 3 | 195 | 25 | 67.72 | 2.14 | .75 | -.79 | .81 | -.58 | p .00 | .32 | 56.0 | 42.2 | P03 |
| 5 | 207 | 25 | 74.43 | 2.64 | .74 | -.74 | .76 | -.70 | o .48 | .27 | 48.0 | 41.1 | P05 |
| 32 | 208 | 25 | 75.15 | 2.71 | .76 | -.68 | .68 | -.99 | n .51 | .26 | 60.0 | 44.6 | P32 |
| 18 | 138 | 25 | 50.59 | 1.51 | .74 | -.90 | .73 | -.96 | m .44 | .41 | 56.0 | 30.4 | P18 |
| 9 | 191 | 25 | 65.98 | 2.03 | .73 | -.89 | .64 | -1.28 | l .51 | .33 | 72.0 | 39.9 | P09 |
| 20 | 195 | 25 | 67.72 | 2.14 | .69 | -1.04 | .71 | -.98 | k .32 | .32 | 40.0 | 42.2 | P20 |
| 12 | 156 | 25 | 54.95 | 1.61 | .69 | -1.17 | .68 | -1.23 | j .27 | .39 | 36.0 | 29.9 | P12 |
| 34 | 96 | 25 | 41.96 | 1.38 | .53 | -2.13 | .64 | -1.49 | i-.05 | .42 | 28.0 | 24.7 | P34 |
| 4 | 194 | 25 | 67.27 | 2.11 | .51 | -1.90 | .45 | -2.22 | h .19 | .32 | 68.0 | 42.0 | P04 |
| 8 | 164 | 25 | 57.08 | 1.66 | .48 | -2.26 | .48 | -2.27 | g .76 | .38 | 36.0 | 30.7 | P08 |
| 19 | 142 | 25 | 51.52 | 1.53 | .44 | -2.42 | .44 | -2.44 | f .38 | .41 | 32.0 | 29.9 | P19 |
| 38 | 158 | 25 | 55.47 | 1.62 | .42 | -2.62 | .40 | -2.73 | e .03 | .39 | 48.0 | 30.5 | P38 |
| 22 | 153 | 25 | 54.19 | 1.59 | .37 | -2.89 | .34 | -3.17 | d .56 | .40 | 60.0 | 29.9 | P22 |
| 2 | 125 | 25 | 47.72 | 1.46 | .22 | -4.06 | .21 | -4.13 | c .00 | .43 | 64.0 | 30.7 | P02 |
| 37 | 175 | 25 | 60.29 | 1.77 | .16 | -4.83 | .14 | -5.06 | b .00 | .37 | 84.0 | 31.5 | P37 |
| 30 | 200 | 25 | 70.18 | 2.30 | .10 | -4.98 | .08 | -5.31 | a .00 | .30 | 96.0 | 43.2 | P30 |
| MEAN | 183.6 | 25.0 | 69.68 | 3.81 | 1.13 | -.14 | 1.03 | -.34 | | | 45.2 | 38.6 | |
| P.SD | 31.8 | .0 | 19.47 | 4.99 | .83 | 2.43 | .66 | 2.27 | | | 20.5 | 10.4 | |

**Figure 3: Persons Measure**

The **Wright Map (Person-Item Map)** as shown in Figure 4 provides a visual representation of how the test items align with the ability levels of the test-takers. On the left side, participants are ranked based on their ability, while on the right side, test items are arranged according to their difficulty level. The middle vertical line represents the shared logit scale, where higher values indicate higher ability or difficulty. This helps to assess whether the test items are appropriately matched to the range of test-takers' abilities.

From the analysis, high-ability participants (above 70 logits) such as **P06, P28, and P35** are not well-matched with correspondingly difficult items, suggesting that the test lacks sufficiently challenging questions for them. The majority of participants fall in the **50–70 logit range**, where items like **F2, B10, and B7** appear to be well-targeted for average ability levels. Meanwhile, lower-ability participants (below 50 logits) struggle even with the easiest items, which include **D1, D3, D5, and F5**, indicating these items may be too simple.

To improve the test, additional difficult items should be introduced to better differentiate high-performing individuals. The mid-range difficulty items seem well-aligned with the average test-takers, meaning they contribute effectively to the assessment. However, the lower-ability participants may require better-targeted items that more precisely measure their skill levels. Overall, while the test is effective for mid-range participants, refinements are needed at both ends of the ability spectrum for better measurement accuracy.

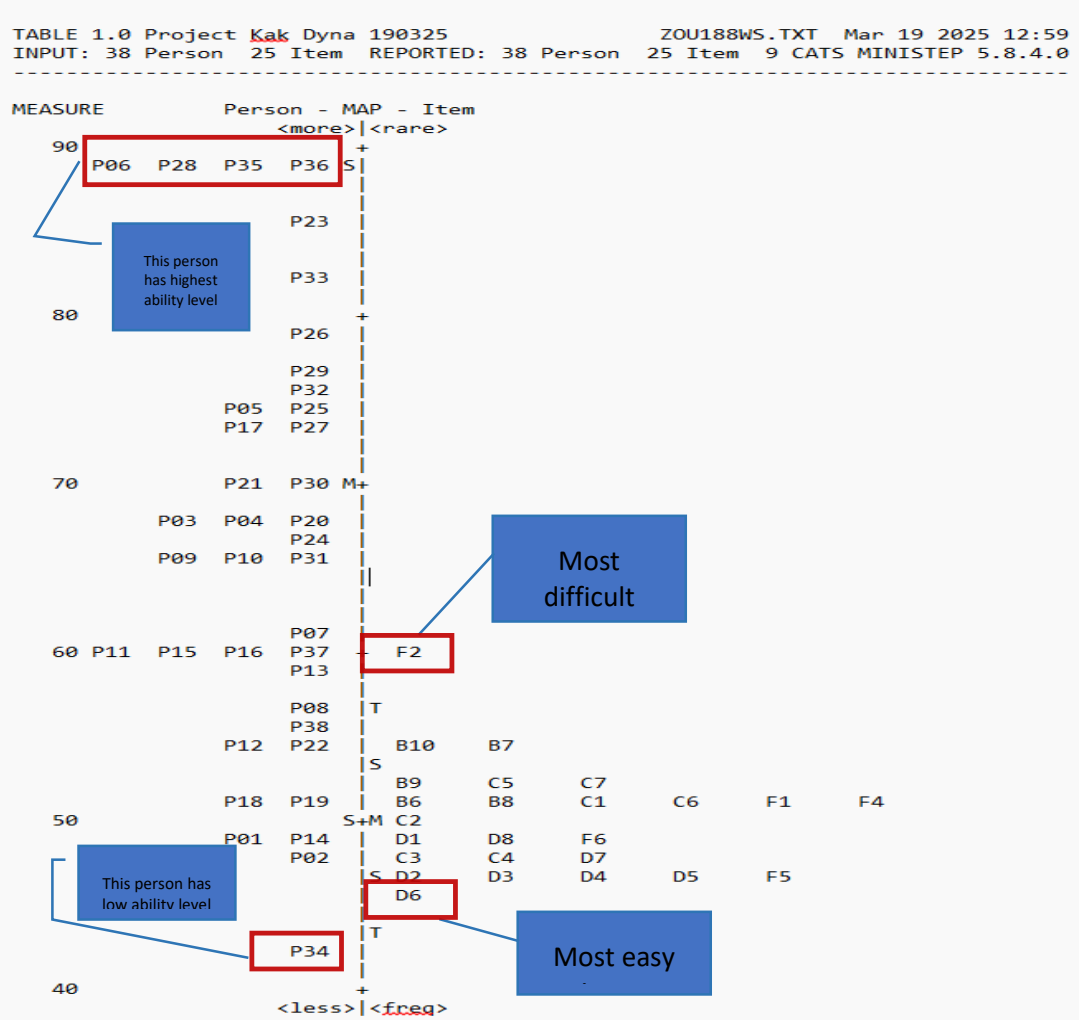
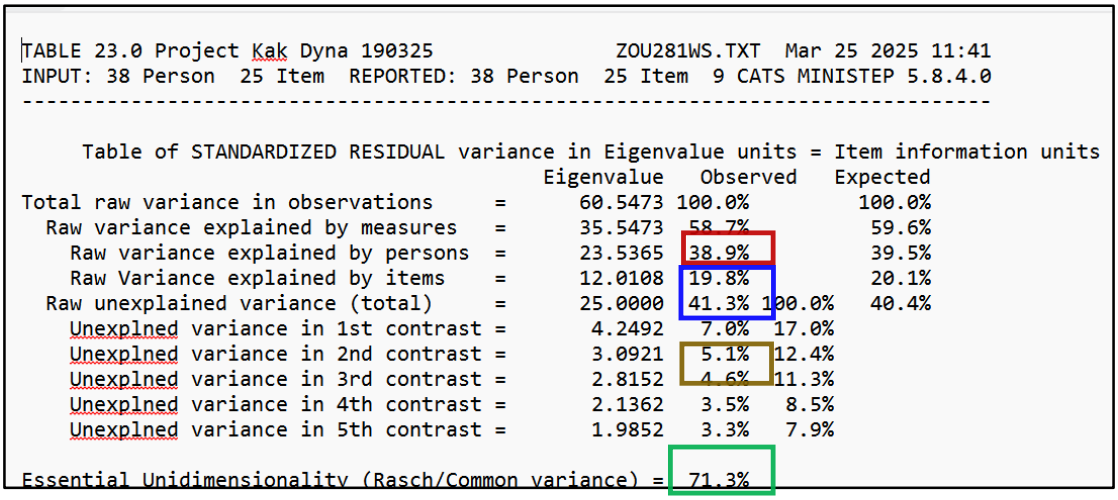



**Figure 4: Wright Map**

**Unidimensionality**

Unidimensionality in Rasch is the key component of content validity. It refers to how well the items fit the constructs. In dimensionality analysis, the variance explained by the first contrast in the residuals indicates whether there could be another dimension exists. The Standardized Residual Variance Table provides insights into the dimensionality of the data and the extent to which the measurement model explains variance. The Rasch analysis of the 25-item scale administered to 38 persons revealed that 58.7% of the total variance (60.5473 units) was explained by the model, with 38.9% attributed to person abilities and 19.8% to item difficulties. The remaining 41.3% unexplained variance suggests some noise or potential secondary dimensions. The largest secondary dimension (1st contrast) accounted for 7.0% of total variance (17.0% of unexplained variance), while subsequent contrasts were smaller (ranging from 3.3% to 5.1% of total variance). The essential unidimensionality index of 71.3% indicates that the scale is predominantly unidimensional, meeting the typical threshold (>60%). However, the modest explained variance and notable secondary contrasts (particularly the 1st contrast) warrant further investigation—such as reviewing misfitting items or assessing whether the contrasts align with substantive subscales or artifacts (e.g., response biases). Overall, the scale demonstrates acceptable unidimensionality but may benefit from refinement to reduce unexplained variance and clarify minor secondary dimensions.



```
TABLE 23.0 Project Kak Dyna 190325              ZOU281WS.TXT  Mar 25 2025 11:41
INPUT: 38 Person  25 Item  REPORTED: 38 Person  25 Item  9 CATS MINISTEP 5.8.4.0
-------------------------------------------------------------------------------

     Table of STANDARDIZED RESIDUAL variance in Eigenvalue units = Item information units
                                        Eigenvalue   Observed   Expected
Total raw variance in observations     =      60.5473 100.0%         100.0%
  Raw variance explained by measures   =      35.5473  58.7%          59.6%
    Raw variance explained by persons  =      23.5365  38.9%          39.5%
    Raw Variance explained by items    =      12.0108  19.8%          20.1%
  Raw unexplained variance (total)     =      25.0000  41.3% 100.0%   40.4%
    Unexplned variance in 1st contrast =       4.2492   7.0%  17.0%
    Unexplned variance in 2nd contrast =       3.0921   5.1%  12.4%
    Unexplned variance in 3rd contrast =       2.8152   4.6%  11.3%
    Unexplned variance in 4th contrast =       2.1362   3.5%   8.5%
    Unexplned variance in 5th contrast =       1.9852   3.3%   7.9%

Essential Unidimensionality (Rasch/Common variance) =  71.3%
```

**Figure 5: Unidimensionality**

## Conclusion

The Rasch model analysis of the pilot study demonstrated strong measurement properties, with high person reliability (.89) and acceptable item reliability (.71), indicating the instrument's effectiveness in assessing individual abilities. While the test showed good model-data fit for most items and persons, minor misfits were identified, particularly for item F2, which requires revision or removal. The Wright Map revealed a need for more challenging items to better differentiate high-ability participants, as well as better-targeted items for lower-ability individuals. Unidimensionality analysis confirmed the scale's predominant adherence to a single construct (71.3%), though secondary dimensions accounted for some unexplained variance, suggesting areas for refinement. Overall, the findings support the validity of the assessment for measuring the intended latent traits, with targeted improvements recommended to enhance precision and address misfitting elements

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