Strategic Approach in RASCH Measurement Model Using GDIF for Mooney Problem Checklist (MPCL) Psychometric Properties

Mohd Effendi @ Ewan Mohd Matore, Ahmad Zamri Khairani, Nor Mashitah Mohd Radzi, Nurul Hasyimah Mat Rani, Norasmah Othman, Rafidah Adnan

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Abstract: This study is aimed to apply the strategic approach in Rasch model using the Gender Differential Item Functioning (GDIF) for Mooney Problem Checklist (MPCL) items in the context of polytechnics. MPCL was measured by eleven dimensional category covers issues such as (i) health; (ii) finance; (iii) recreation; (iv) courtship; (v) social; (vi) personal; (vii) religion; (viii) family; (ix) career; (x) education and (xi) learning. The MPCL was administered to 252 sample of respondents selected from seven polytechnics in Malaysia and convenience sampling technique was employed. Data were analyzed using WINSTEPS 3.71.0. The findings showed 21 items were eliminated based on GDIF, MNSQ and PTMEA. A total of 244 items was found to have met the main assumptions of Rasch model. The study suggested that the items need to be restructured in order to ensure the fairness among genders. Thus, this study provided a significant contribution to the aspect of psychometric properties for MPCL.

INTRODUCTION

Mooney Problem Checklist (MPCL) was introduced by Ross L. Mooney and Leonad V. Gordon in 1950. MPCL originally developed with 330 items and covered eleven dimensional categories of challenges and adversities (Mooney & Gordon, 1950). Previous research revealed that some of them are using MPCL with the descriptive analysis. Alpha Cronbach and t test (Azizi Yahaya, DK Zainab PgTuah, Zeliha Mohammad Ali, & Gooh Mo Lee, 2014) and pareto analysis (Alavi & Syed Mohamed Shafeq Mansor, 2011). One of the important aspect that been neglected by the researcher are to indicates whether an item is easier agreed by male or female or namely Gender Differential Item Functioning (GDIF). The objective of DIF is used to detect the biased item, and ensure that the instruments are built equally (Siti Rahayah Ariffin, Rodiah Idris, & NoriahMohd Ishak, 2010). DIF seeks to determine whether test scores are affected by different sources of variation in different samples (Bond & Fox, 2015). Gender is often quoted repeatedly as factors that can raise the DIF value (Lamprianou, Boyle, & Nelson, 2002). By analyzing GDIF, the study identifies items that show signs of inequity when a group of students of different ability levels of the same sex being compared. The idea of this paper is to apply the strategic approach in Rasch model using the Gender Differential Item Functioning (GDIF) for Mooney Problem Checklist (MPCL) items in the context of polytechnics.

LITERATURE REVIEW

Why Polytechnics?

Nowadays, most of the researchers are pointing out the needs of Fourth Industrial Revolutions (IR4), to see humans and machines collaborate together using cognitive technology in an industrial environment transformation (Liao et al., 2017; Zhong, Xu, Klotz, & Newman, 2017). One of the important
transformations is Polytechnic Transformation. It was aimed in producing human capital with first class mentality and ability to compete in the global market and aims to improve the highly skilled workforce from 23 to 37% by year 2015 (Jabatan Pengajian Politeknik, 2013). In addition, recent years have brought enormous changes in all aspects of life, and universities all over the world have been confronted by dramatic changes in their external and internal environments (Hassanien, 2017). Not only in Malaysia, but Ukuma, Tiough, and Amenger (2016) also wrote about strategizing Technical and Vocational Education towards best global practice for accelerated sustainable development of Nigeria. Some researchers had put the effort to know what type of the challenges that technical students in polytechnic are facing nowadays using MPCL (Mohd Effendi Mohd Matore & Ahmad Zamri Khairani, 2014, 2015). The gap here is the lack of empirical evidence of psychometric in terms of item biasness to gender of MPCL. Then, the objective of this paper is to strategize the items in terms of item fairness using GDIF analysis among polytechnic students.

**How Far the Research on GDIF was Conducted?**

Previous research showed their interest on investigating the gender on DIF (Alavi & Bordbar, 2017; Lin, Griffiths, & Pakpour, 2018; Rahmani, 2018). Many researches nowadays are focusing on evaluating educational test fairness and validity. The analyses of DIF are well known among the researchers cross the countries (Alavi & Bordbar, 2017; Ali & Green, 2017; Hagquist & Andrich, 2017; Sharafi, Mousavi, Ayatollahi, & Jafari, 2017). Nevertheless, some of them are focusing on other factors like education background, school location and age. The area of study towards GDIF covered some interesting topics such as teacher’s pedagogical content knowledge (Rahmani, 2018), nomophobia (Lin et al., 2018), psychological distress (Ali & Green, 2017), and language proficiency test (Alavi & Bordbar, 2017). Some of the researchers in Malaysia tested DIF for their new instruments (Sarimah Mokhtar, Mohd Kashfi Mohd Jailani, Ab. Halim Tamuri, Mohd Aderi Che Noh, & Kamarulzaman Abdul Ghani, 2011; Siti Rahayah Ariffin, Farhana Ahmad Katran, Ayesha Abdullah Najieb Badib, & Nur Aidah Rashid, 2011). Unfortunately, most of them are not aware about the importance of DIF for their items.

**METHODOLOGY**

This study was conducted by using quantitative approach and survey of research design. The 252 students in seven polytechnics were selected using convenience sampling because the ability to provide a good cooperation, accessible, voluntary (Cohen, Manion, & Morrison 2007). The respondents came across eight various departments and year of study. The selection was based on zones (North, West, East, South, and Borneo). The concept of the challenges students based on the dimensions of MPCL by Mooney & Gordon (1950) with eleven-dimensional category covers issues and 327 items such as (i) health; (ii) finance, (iii) recreation; (iv) courtship; (v) social; (vi) personal; (vii) religion; (viii) family; (ix) career; (x) education and (xi) learning. MPCL is an instrument for student problems checklist which is most widely used and popular in Malaysia because the features are very easy to be administered and interpreted. The data was inserted using SPSS version 23.0 and WINSTEPS version 3.71.0.1 for Rasch findings.

**RESULTS AND DISCUSSIONS**

**Respondent Characteristics**

The respondents indicated 252 students in seven polytechnics and eight various departments. There were 126 students (50%) for each males and females. Most of the respondents are from Sabah (19.8%). In terms of semester of study, most of them are from first and second semester (22.2%) and the department of Commerce (24.6%) is the most dominant.

**GDIF Analysis based on MPCL Constructs**

Figure 1 to 11 revealed the difference of DIF measure between male (1) and female (2) students. The DIF contrasts were fulfilled the range of acceptance of -0.5 to +0.5. Lai and Eton, (2002) and Wang (2008) emphasized that the value of -0.5 to +0.5 of logits DIF contrast would be vital for Likert scale. Bond and Fox (2015) proposed three DIF indicators, namely t value (between -2 to +2), DIF contrast of -0.5 to +0.5 logits and p value which is less than 0.05. GDIF size of less than 0.5 logits considered unimportant and be ignored.
Table 1 shows the item deleted based on several analyses of Rasch such as MNSQ, PTMEA and GDIF. This paper was focused on 21 items deleted by GDIF.

Table 1: Items deleted for each construct based on PTMEA, MNSQ and GDIF

<table>
<thead>
<tr>
<th>Construct</th>
<th>Total items</th>
<th>PTMEA</th>
<th>Recommended deleted items</th>
<th>Total deleted items</th>
<th>Items retained</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Health</td>
<td>30</td>
<td>3, 4</td>
<td>1, 2, 5, 7, 8, 9, 10, 12, 13, 14, 16, 17, 18, 25</td>
<td>24</td>
<td>17</td>
</tr>
<tr>
<td>2. Finances</td>
<td>30</td>
<td>47, 55</td>
<td>31, 33, 34, 35, 36, 37, 39, 40, 41, 42, 43, 44, 45, 46, 50, 51, 54, 58</td>
<td>56</td>
<td>21</td>
</tr>
<tr>
<td>3. Recreation</td>
<td>30</td>
<td>72, 73, 74, 61, 64, 70, 78, 81, 84</td>
<td>-</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>4. Courtship</td>
<td>27</td>
<td></td>
<td>97, 99, 104</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>5. Social</td>
<td>30</td>
<td></td>
<td>120, 128, 139, 149</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>6. Personal</td>
<td>30</td>
<td></td>
<td>151,158,160,163,164</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>7. Religion</td>
<td>30</td>
<td></td>
<td>178, 186, 191, 195, 200, 203</td>
<td>179</td>
<td>7</td>
</tr>
<tr>
<td>8. Family</td>
<td>30</td>
<td>222</td>
<td>227</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>9. Career</td>
<td>30</td>
<td></td>
<td>259,260,261,262</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>10. Education</td>
<td>30</td>
<td>275, 278, 287, 290</td>
<td>282</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>11. Learning</td>
<td>30</td>
<td>310</td>
<td>-</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>327</td>
<td>10</td>
<td>52</td>
<td>21</td>
<td></td>
</tr>
</tbody>
</table>

Results revealed that the items number 24, 56, 97, 99, 104, 128, and 227 are favourable to female. Items number 120, 139, 141, 151, 158, 160, 163, 164, 179, 259, 260, 261, 262, and 282 are favourable to male. All
these items were suggested to be restructured and needs experts' valuation. Figure 12 shows the GDIF size for the item deleted between DIF measures for both genders. The size is nearly ± 0.5 and failed to follow the requirements of t value that should be ± 2.0. Figure 13 revealed that those items which were out of range will be deleted. These items need to be considered to be review in order to make it applicable for polytechnic context.

![Figure 12](image1.png)  
**Figure 12**  
GDIF Size for item deleted

![Figure 13](image2.png)  
**Figure 13**  
The t value for item deleted

**CONCLUSIONS**

GDIF analysis for MPCL proved that several items need to be corrected and restructured to ensure the fairness of the items. The researcher should take this GDIF into their considerations because they can explore more about the potential of testing DIF between groups, location or courses. In a nutshell, this research had achieved the target to contribute more on psychometric testing of MPCL items especially to apply the strategic approach in Rasch model using the GDIF for Mooney Problem Checklist (MPCL) items in the context of polytechnics.

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