ABSTRACT
Technical vocational teacher education is a program for training individuals who shall hold citizenship that will contribute to the sustenance of the development of the nation. This could be best achieved where technical vocational teacher education program focuses much on obtaining skill acquisition that aligns with changes in occupational trends of today’s workforce. Its synthesis has thus focused on re-focusing technical vocational teacher education towards green skill acquisition for sustainable development in Nigeria. The paper highlighted the concept of technical vocational teacher education as well as green skills. The paper also viewed the relevance of green skills in technical vocational teacher education. Challenges facing technical vocational teacher education in achieving sustainable development through green skill acquisition were explored. Finally, restructuring of technical vocational teacher education to emphasize green nonpractical skill acquisition, recruiting quality and qualified teaching personnel, constant sponsorship of teaching personnel to attend seminars and workshops, and effective teaching methods were discussed. However, head-to-head discussions between students and teachers regarding the need for research literacy courses in research universities deemed necessary.

INDEX TERMS: Re-focusing, Technical Vocational Teacher Education, Green Skills Acquisition, Sustainable Development.

I. INTRODUCTION

Higher education institutions in Malaysia are continuously challenging the government to increase the number of postgraduate students with increasing the number of high-quality researchers. Therefore, the institutions have increased their contribution to the research and publication in international journals. These increases in the number of postgraduate students have increased the number of students who are capable of producing a good quantity and quality of research. However, research reading and writing are deemed as challenging by the students. It is also considered as one of the research barriers in postgraduate studies [4][5][6].

Primary research articles generally composed of an abstract, introduction, method, result, and discussion. Studies reported that the hardest section to understand from the research articles perceived by students are the methodology and data interpretation sections [7][8]. Reading research articles requires students to understand, interpret and make sense of methods used, correlate them with data and discussion presented. However, due to the lack of essential knowledge such as research methodology and data analysis, Round and Campbell (2013) reported that students struggle to understand the figures and data sections. Li et al. (2016) also reported that lack of understanding research methods makes it hard for students to interpret figures and data. Consequently, students are forced to spend more time reading texts to understand them, and consider them as facts instead of understanding the data and figures [8].

The term that associates with the ability to understand and interpret research articles is called research literacy. To be exact, research literacy is defined as the ability to search and identify relevant research articles from relevant resources, and interpret and evaluate research articles [9][10][11][12][13][14][15].

Research literacy has been substantially studied in the context of higher education. However, there is still a limited number of studies on research literacy in higher education. Therefore, research literacy is deemed necessary for professional and society. Moreover, students are facing difficulties in understanding research articles. Teachers also face difficulties in teaching research literacy to students [16][17][18][19].

There are also studies that suggest the inclusion of research literacy in research courses [20][21][22]. These studies emphasize the importance of research literacy in the educational field. However, so far there are only few research literacies in higher educational institutions that were conducted to evaluate the effectiveness of research courses in research universities in Germany [23][24]. In Germany, specifically, most of the universities are research universities, research literacy is seen as an integral part of the curriculum.
eral definition of standard and objectives for German Higher Education degrees [24].

Therefore, this study found it necessary to measure the research literacy levels of postgraduate students in research universities. For this purpose, this study develops Research Literacy Test (RLT). Rasch Measurement Model (RMM) is utilized to examine and evaluate items in the RLT. Additionally, data computation was performed by RMM to ensure that the sample size used is appropriate and relevant to measure postgraduate research student's ability. RMM converts raw-score to measure on a logit scale [26]. RMM is the most basic measurement model in Item Response Theory (IRT) based models which estimate only one parameter, difficulty parameter. In RMM, the standard error of measurement and guessing probability have to be constant [27] [28].

RMM has been widely used to develop, evaluate, and improve any measurement instrument. RMM also been utilized in facilitating a computerized adaptive test [29] [30]. This is due to the capability of RMM in analyzing and providing the same measurement instrument used. RMM analysis also can provide measurement which is expressed on an equal interval scale [30]. Perhaps, the most advantage of RMM is that it can provide measurement invariant across different groups. Therefore, the chosen model is evaluated to determine the quality of a test due to its advantages over Classical Test Theory (CTT). RMM provides a better estimation of students' ability, instead of using the raw score as the true score to indicate students' ability, RMM converts raw-score to measure on an equal interval scale [30].

This result suggested that the ability of students in RLT was sensitive to the nature of the test, at least for different levels of ability. The reliability of the instrument is between 0.85 to 0.89. This means that all items in RLT are appropriate and relevant to measure postgraduate research student's ability. RMM was utilized to identify research literacy levels of postgraduate researchers.

Prior to determining research literacy level, Research Literacy Test (RLT) was validated by four subject-matter experts and the rater agreement of the experts was determined using Fleiss Kappa. The kappa value of each domain of research literacy is between 0.85 to 0.89. This means that all items in RLT are appropriate and relevant to be used to measure postgraduate research student's ability.

Findings from the pilot study which involved 72 respondents shows that RLT has a person separation of 2.34 and a reliability of 0.85. This result suggested that the ability to interpret statistical results of standardized tests is the ability to interpret statistical results. The reliability of the instrument is between 0.85 to 0.89. This means that all items in RLT are appropriate and relevant to measure postgraduate research student's ability. RMM was utilized to identify research literacy levels of postgraduate researchers.

The main population for this study is postgraduate research students in five research universities. Rasch Measurement Model (RMM), a two-parameter model was selected for this purpose. Rasch Measurement Model (RMM) was developed by Warne (2008) and was classified into each level based on the person's ability. After the thresholds were determined, respondents were classified into each level based on the person's ability. Person separation index indicates how items are able to distinguish different levels of ability [32]. While item separation index indicates how items are able to separate items level [32].

Table 1 Research Literacy Domains

<table>
<thead>
<tr>
<th>Domain</th>
<th>Subdomain</th>
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<tbody>
<tr>
<td>Information</td>
<td>-ability to recognize different types of academic documents (based on reference and citation)</td>
</tr>
<tr>
<td>Literacy</td>
<td>-ability to recognize relevant information in research articles</td>
</tr>
<tr>
<td>Knowledge</td>
<td>-ability to differentiate between quantitative and qualitative in terms of methods/designs/data collection and sampling</td>
</tr>
<tr>
<td>of Research</td>
<td>-establishing validity and reliability</td>
</tr>
<tr>
<td>Methodology</td>
<td>-knowledge of statistical concepts and terminologies</td>
</tr>
<tr>
<td>Statistical</td>
<td>-knowledge of statistical tests</td>
</tr>
<tr>
<td>Literacy</td>
<td>-ability to interpret statistical results based on data, charts and graphs</td>
</tr>
</tbody>
</table>

[26] | Warren, I. (2008). Rasch Measurement Model (RMM), a two-parameter model was selected for this purpose. Rasch Measurement Model (RMM) was developed by Warne (2008) and was classified into each level based on the person's ability. After the thresholds were determined, respondents were classified into each level based on the person's ability. Person separation index indicates how items are able to distinguish different levels of ability [32]. While item separation index indicates how items are able to separate items level [32].

[27] | Ilmananetal (2008)
stated that one should calculate item separation, item reliability and item stratification to examine how well the persons separate the items.

III. FINDINGS

From the analysis of data from 236 respondents, Research Literacy Test (RLT) yielded reliability of 0.94 with a separation of 4.13. High reliability and high separation indicate that the sample in the study is large enough to confirm the hierarchy. This resulted in literacy levels, 

\[ H = \frac{(4 \times 4.13) + 1}{3} = 5.84 \approx 6 \]  

Levels. Results are shown in Table 2.

<table>
<thead>
<tr>
<th>Table 2 Item Statistics</th>
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<tbody>
<tr>
<td>Item Reliability</td>
<td>0.94</td>
</tr>
<tr>
<td>Separation</td>
<td>4.13</td>
</tr>
<tr>
<td>Strata</td>
<td>6 levels</td>
</tr>
<tr>
<td>Mean</td>
<td>0.00</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>0.62</td>
</tr>
</tbody>
</table>

Six levels are classified as Very Low, Low, Moderate Low, Moderate High, High and Very High. Table 3 shows the threshold range and threshold logit. Respondents who have person logit less than or equal to -2SD(-1.24) will be classified as Very Low in research literacy. In contrast, respondents who have person logit more than or equal to +2SD(+1.24) will be classified as Very High in research literacy. The same rules applied for each level in between Very Low and Very High level as shown in Table 3.

<table>
<thead>
<tr>
<th>Table 3 Threshold Logit of Research Literacy Level</th>
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</thead>
<tbody>
<tr>
<td>Research Literacy Level</td>
<td>Threshold Range</td>
</tr>
<tr>
<td>Very Low</td>
<td>≤ -2SD</td>
</tr>
<tr>
<td>Low</td>
<td>-2SD &lt; Low ≤ -1SD</td>
</tr>
<tr>
<td>Moderate Low</td>
<td>-1SD ≤ ML &lt; Mean</td>
</tr>
<tr>
<td>Moderate High</td>
<td>Mean ≤ MH &lt; 1SD</td>
</tr>
<tr>
<td>High</td>
<td>1SD ≤ High &lt; 2SD</td>
</tr>
<tr>
<td>Very High</td>
<td>≥ 2SD</td>
</tr>
</tbody>
</table>

The distribution of respondents according to their research literacy level is shown in Figure I. The majority of respondents are in the moderate level; Moderate Low (33.47%) and Moderate High (24.58%). Only the smallest number of respondents are in Very Low level (11.02%) and Very High level (6.36%).

Table 2 shows that 38.56% of respondents are on Moderate High level followed by Moderate Low (18.22%) of respondents. Only 2.12% of respondents are at Very Low level. The mean ability logit of information literacy is 0.30, which indicates that the respondents' information literacy level is at Moderate High.

As for knowledge of research methodology level, shown in Figure III, the majority of respondents are at Moderate Low (25%) followed by Moderate High (8.9%). The respondents are at Very Low level while only 11.02% of respondents are at Very High level. Overall, the mean ability logit is 0.30, which indicates that the respondents' knowledge of research methodology level is at Moderate Low.

Statistical literacy level of postgraduate students is also at Moderate Low level with the mean ability of -0.05 logit as shown in Figure IV. The majority of students with 25% of them are at Moderate Low level followed by Low level with 21.61%. More than 10% of students are at Very Low level. 13.98% of students are at Very High level and 26% of students are at High Level.
Firstly, overall research literacy level of the postgraduate students is at Moderate Low. Among three domains of research literacy, postgraduate research students appeared to perform better in information literacy with the mean personality at Moderate High while their mean personality in research methodology and statistical literacy is at Moderate Low. These results from this study are similar to studies by GroßOphoff et al. (2015) and GroßOphoff et al. (2017b). In his study, they also found that information literacy score of postgraduate students is higher than her than her horticultural students; statistical literacy and evidence-based reasoning.

There are three components in information literacy component: locating and retrieving research articles, recognized different types of academic documents and search and recognize information presented in these research articles. Overall, this study revealed that information literacy level of postgraduate students is at Moderate High level which is contrary to Conway (2011). This study had found that postgraduate students’ performance in all information literacy skills was not satisfactory. This study additionally examined difficulty levels of each sub-component of information literacy. This study revealed that the hardest sub-component is knowledge and recognition of information presented in electronic scholarly resources. Previous literature, (e.g., [38][39][40]) also had discussed the difficulty of students in understanding research methodology. Similarly, studies also revealed that lack of knowledge of research methodology is one of the barriers in understanding research articles [41][42][43]. Further additional analysis found that among the three sub-components; items measuring quantitative research approach were the most difficult to answer by the postgraduate students in this study.

The difference of difficulty level between students who used search tools’ research orientation. GroßOphoff et al. (2017b) study revealed that the lower score in educational research literacy due to students are more oriented to qualitative approaches while their research literacy test is quantitative in nature.

Lastly, statistical literacy is the hardest component of research literacy in his study with the mean ability logit of postgraduate students is at 0.02 (Moderate Low). Statistical literacy included familiarity with statistical concepts, statistical test and interpreting data. The most difficult item in statistical literacy is data interpretation. Li et al. (2016) and Hubbard and Dunbar (2017) revealed that postgraduate students perceived that interpreting “experimental data” are difficult. This study proved that students are weak at interpreting results from tables and graphs.

Previously, this study already revealed that students had difficulty answering quantitative research approach items compared to qualitative research approach items. As statistical literacy is a way associated with quantitative research methodology, this could be the reason why students did not perform well in statistical literacy. Additionally, GroßOphoff et al. (2015) and GroßOphoff et al. (2017b) studies also suggested that one of the reasons postgraduate students have lower scores in statistical literacy compared to other research orientations. Empirically, Löwe et al. (2014) and Gonulal (2016) studies also revealed that students who have a quantitative orientation were more likely to perceive statistical significance compared to students who have a qualitative orientation.
V. CONCLUSION

Firstly, this study utilized RaschMeasurementModel(RMM) in both instrument validation and data interpretation. RMM can facilitate in the research instrument validation (e.g., questionnaire content). This study proves that following the right procedures to develop and test the analytical tool could produce a valid and reliable test.

The one advantage of RMM is that it expresses an unequal inter-rater scale. Thus, researchers can use the data in a statistical test (descriptive and parametric test), (ii) compare confidently student’s ability. In Classical Test Theory (CTT), students' ability is determined by the total test items taken equal in the same difficulty level. Thus, the assumption of raw scores cannot be confidently used to compare students' performance.

The results of this study could give some insights about postgraduate students' struggles. This study revealed that search literacy is low for postgraduate research students in educational management. Moderate low, this study also revealed that their knowledge of research methodology is moderate to low. Postgraduate students also perform poorly in statistical literacy. To be exact, students struggle in hypothesis testing (significant value) data.

Inability to understand and interpret research articles has been a long-standing issue for postgraduate research students. Lack of research literacy not only delays research writing but it affects the quality of research probably due to misinterpretations of research. Therefore, postgraduate students should be aware of their own ability and find initiatives to increase their research literacy. Faculty may provide intensive coursework to postgraduate students to enhance their skills in data analysis and academic reading. Similarly, librarians can also provide intensive information and literacy courses to postgraduate students, especially in how to search research articles in databases.

REFERENCES


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