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Application of The Rasch Model in Research Publications: A Bibliometric Analysis

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ABSTRAK

Model Rasch merupakan teknik yang ideal untuk menilai respons secara teratur dan meningkatkan analisis data. Model ini merupakan instrumen yang berguna untuk mengukur pencapaian dalam tes pendidikan dan psikologi. Namun, penting untuk mengidentifikasi potensi keterbatasan model dan mempelajarinya dalam penelitian di masa depan. Analisis bibliometrik penelitian digunakan untuk menentukan tren penelitian tentang penggunaan model Rasch. Pencarian literatur ekstensif dilakukan dengan menggunakan database scopus pada tanggal 19 Februari 2023, dengan menggunakan kata kunci "model Rasch". Temuan menunjukkan bahwa model Rasch adalah alat pengujian yang diterima secara luas dan berguna yang mungkin lebih efektif daripada metode alternatif. Meskipun model Rasch adalah alat yang berguna untuk mengkalibrasi tes psikologi, namun penting untuk menangani masalah yang mungkin terjadi saat menggunakannya. Oleh karena itu, sangat penting untuk mengevaluasi hasil dengan hati-hati dan memahami keterbatasan model Rasch ketika menggunakan psikotes.

Kata Kunci: Bibliometric; Model Rasch; Statistika terapan.

ABSTRACT

The Rasch model is an ideal technique for regularly assessing responses and improving data analysis. This model is a useful instrument for measuring achievement in educational and psychological tests. However, it is important to identify potential limitations of the model and study them in future research. Bibliometric analysis of research was used to determine research trends regarding the use of Rasch models. An extensive literature search was conducted using the Scopus database on February 19, 2023, using the keyword "Rasch model". The findings suggest that the Rasch model is a widely accepted and useful testing tool that may be more effective than alternative methods. Although the Rasch model is a useful tool for calibrating psychological tests, it is important to address the problems that may occur when using it. Therefore, it is important to evaluate the results carefully and understand the limitations of the Rasch model when using psychological tests

Keywords: Bibliometric; Rasch model; Applied statistic.

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1. INTRODUCTION

The Rasch model is a well-known latent trait model that is used to evaluate responses in two or more ordered categories. According to Masters (1982), Rasch model gives a full summary of all the ways the model can be used. Wright & Mok (2004) also argue that the Rasch model helps us understand the universe by showing us how experience is continuous, but when we look at it, it becomes discrete. This means that the model provides a deeper comprehension of how the world operates. In addition, according to Wright & Mok (2000), the Rasch model provides a mechanism for translating discrete deterministic counts into continuous probabilistic abstractions, hence improving data analysis. The Rasch model demonstrated by Glas (1988) that may be used to test the fit of data to the model, making it a valuable instrument for determining the model's efficacy. According to the studies discussed, the Rasch model is an ideal technique to orderly assess responses, acquire insight into how the world functions, translate data into probabilities, and determine whether data fits the model.

The Rasch model has multiple advantages, including its flexibility, the new test statistics that enhance its accuracy, and the goodness of fit test that assesses its performance (Putra, Hermita, & Alim, 2021). The Rasch model is a valuable tool for scoring responses in two or more ordered categories. The advantages of this model are highlighted in the research papers that have been conducted on it. One advantage of the Rasch model is its flexibility, as indicated by Masters (1982) finding that the Partial Credit model is an extension of the Rasch model. This extension allows the model to be used in diverse ways, making it suitable for various applications. Van den Wollenberg (1982) found that two new test statistics for the Rasch model are sensitive to violations of local stochastic independence and unidimensional. This implies that the new test statistics are an advantage of the Rasch model because they can detect potential problems and thus enhance the model's accuracy. Additionally, Andersen (1973) noted that the goodness of fit test for the Rasch model is based on a comparison between difficulties estimated from different score groups and overall estimates. This indicates that the Rasch model's goodness of fit test is an advantage because it provides a comprehensive analysis of the model's performance.

Based on the studies that were looked at, the Rasch model is a flexible tool that can be used in many different fields. 심재우 (2012) found that the Rasch model is useful for looking at how well items and test-takers do, which means it can be used in educational testing to look at how well students do. Tennant et al. (2004) also argue that needs-based assessments can be made using the Rasch model. This means that the model can be used in health care settings to come up with effective ways to meet different needs. According to Fox & Jones (1998), the Rasch model can be used to figure out the best number of answer categories, which suggests that it could be used in survey research. Lastly, Hagquist et al. (2009) argue that the Rasch model is useful for looking at and making measurement tools. This suggests that the approach can be

implemented in numerous disciplines to build and evaluate measurement tools. In light of this, the examined publications imply that the Rasch model is a flexible instrument that has the potential to be utilized in a variety of contexts.

The research that was looked at shows that Rasch models are a good way to measure achievement in educational and psychological testing, but there are some things to keep in mind. Kubinger (2005) and Kubinger et al. (2011) concurred that Rasch models are beneficial for gauging achievement but pointed out their applicability limitations. El-Korashy (1995) and Törmäkangas (2011) did not specify any limits, meaning that the model is useful for gauging achievement with no obvious limitations. These studies demonstrate that the Rasch model is a useful instrument for measuring accomplishment in educational and psychological testing. Yet, it is vital to identify the model's potential limitations and study them in future research. Understanding the limitations of the application of the Rasch model can result in a more accurate and exact measurement of accomplishment in educational and psychological testing.

Even though the Rasch model is a useful tool for calibrating psychological tests, the reviewed literature shows that there are a few things to keep in mind when using it. Kubinger (2005) found that when using the Rasch model, it is important to think about the possibility of fake model check results and the need to make these results public. Gustafsson (1980) pointed out that there are other things to think about, like the fact that there could be more than one item parameter and more than one person parameter, which can change the results of the analysis. On the other hand, Howard (1985) discovered that the Rasch model is a helpful tool for analysing what happens when students take tests, indicating that it is effective for studying test-taking behaviour. Törmäkangas (2011) came to the conclusion that the Rasch model is the best way to look at how individual items do on a test. This means that it can help find specific problems with test items. So, even though the Rasch model is a useful tool for calibrating psychological tests, it is important to deal with possible problems when using it. The findings of these publications show how important it is to carefully evaluate the outcomes and comprehend the Rasch model's limitations when using psychological testing.

Based on the cited articles, the Rasch model is a widely accepted and useful testing tool. According to Törmäkangas (2011), the Rasch model is the best option for testing, indicating that it may be more effective than alternative methods. Also, Kubinger (2005) suggests that the Rasch model is essential for testing. Andrich et al. (2019) and Glas & Verhelst (1995) provide significant information about the Rasch model itself, but they do not address relevant testing considerations. Consequently, it is vital to investigate alternative sources in order to comprehend any potential limitations or difficulties linked with the use of the Rasch model in testing. Yet, the fact that the Rasch model is generally accepted and acknowledged as an effective testing method suggests that it will likely continue to play a significant role in this sector.

2. METHOD

To determine research trends on the use of Rasch models, this study used bibliometric analysis of research. Bibliometric analysis is a quantitative study of bibliographic material that provides an overview of a particular field of research that can be classified by papers, authors, and journals (Supriyadi, 2022a, 2022b; Supriyadi, Dahlan, Darhim, et al., 2022; Supriyadi, Dahlan, Dasari, et al., 2022). Therefore, this study provided an extensive literature search using the scopus database on February 19, 2023. The keyword used for the search was "Rasch model".

Additionally, this study will analyze the language aspects and research trends in publications based on the year of publication. The objective of this research is to achieve a deeper understanding of the Rasch model in research trends, particularly concerning its broad range and collaborative partnerships. This study also aims to filter the latest data to assist researchers in formulating recommendations for future research on this topic.

3. RESULT AND DISCUSSION

Table 1 provides information on a dataset consisting of 159 documents from 108 sources spanning from 1983 to 2023. The data has an annual growth rate of 2.78% and an average document age of 8.35 years. On average, each document has 9.101 citations and 5714 references. The dataset includes 380 keywords plus IDs and 419 author's keywords. There are 413 authors in total, with 31 single-authored documents and 36 single-authored documents with co-authors. The document types include 131 articles, one book chapter, 22 conference papers, three conference reviews, and two reviews.

Table 1. Main Information About Utilizing Rasch Model

Description	Results	Description	Results
Timespan	1983:2023	Authors	413
Sources (Journals, Books, etc)	108	Authors of single-authored docs	31
Documents	159	Single-authored docs	36
Annual Growth Rate %	2.78	Co-Authors per Doc	2.97
Document Average Age	8.35	International co-authorships %	13.84
Average citations per doc	9.101	Article	131
References	5714	book chapter	1
Keywords Plus (ID)	380	conference paper	22
Author's Keywords (DE)	419	conference review	3
AUTHORS		Review	2

Figure 1 shows the number of articles published each year between 1983 and 2023. There were very few articles published in the early years, with only one article published in 1983, and none in 1984 or 1985. However, the number of articles published began to increase in the 1990s, with a peak of 13 articles in 2012. The number of articles published has remained

consistently high in recent years, with 15 articles published in 2021 and 3 articles published so far in 2023.

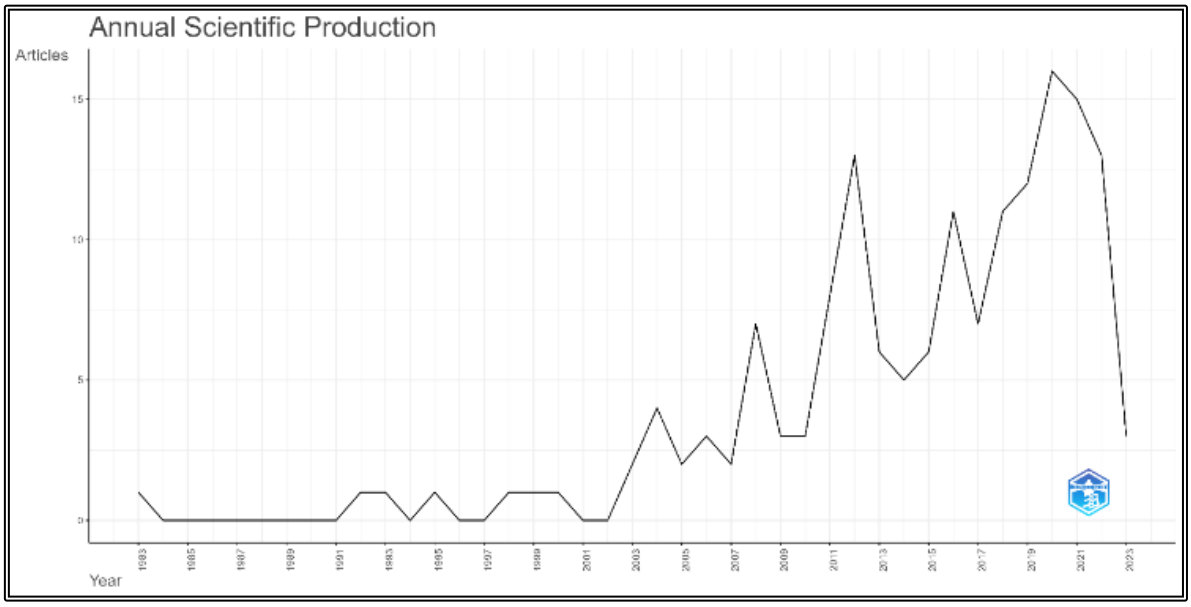

Figure 1. Annual Scientific Production About Utilizing Rasch Model

Figure 2 shows the top sources that have published articles related to measurement and evaluation. The data reveals that the Journal of Applied Measurement is the most popular source, with 10 articles published. The Journal of Physics: Conference Series comes in second place with seven articles, followed by Educational and Psychological Measurement with five articles. AIP Conference Proceedings, Eurasia Journal of Mathematics, Science and Technology Education, International Journal of Science and Mathematics Education, and International Journal of Science Education have all published three or four articles on this topic. Studies in Educational Evaluation and ACM International Conference Proceeding Series round out the top ten sources with two articles each. This information is useful for researchers who want to stay up-to-date on the latest developments in measurement and evaluation and identify top sources for potential publication opportunities.

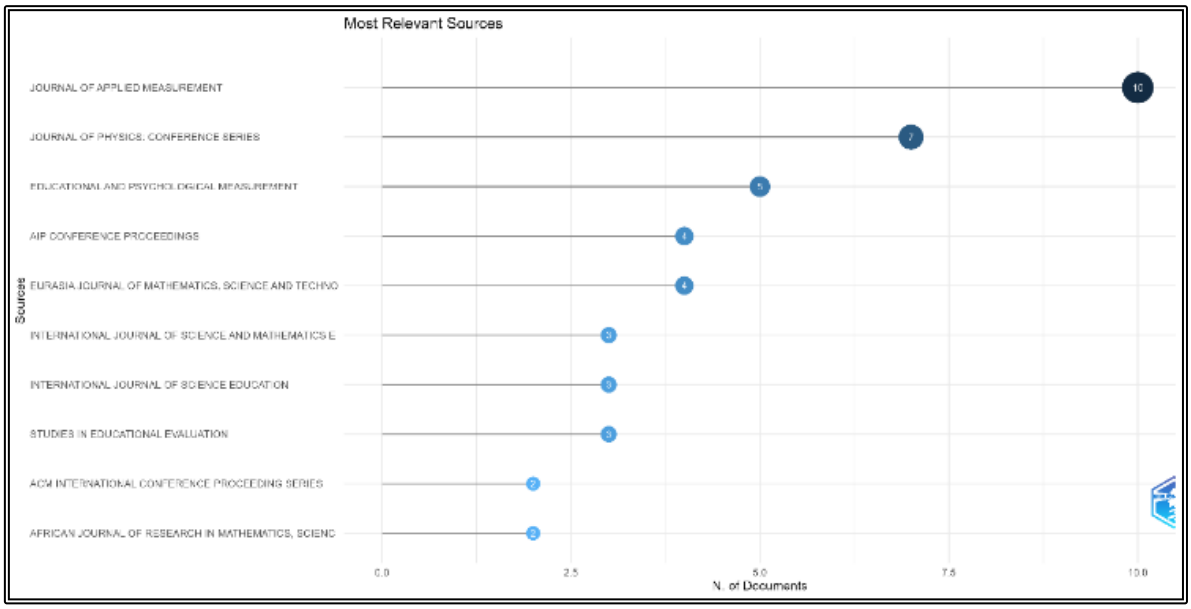

Figure 2. Most Relevant Sources about Utilizing Rasch Model

Figure 3 shows the top affiliations based on the number of articles they have published in a certain field. The affiliation with the most articles is Universiti Kebangsaan Malaysia with 17 articles, followed by Nanyang Technological University with 14 articles, and Universiti Sains Malaysia with 10 articles. The table also shows that some affiliations have published a significant number of articles, with some having as many as five articles published. These include Universitas Pendidikan Indonesia, American Institutes for Research, Universidad de Bogotá Jorge Tadeo Lozano, Universiti Teknologi MARA, University of Pretoria, and University of Riau. The affiliation with the fewest articles published in this table is the Office of Qualifications and Examinations Regulation with only 4 articles. The table provides a quick way to identify the most active affiliations in the field and the distribution of the number of articles published by each affiliation.

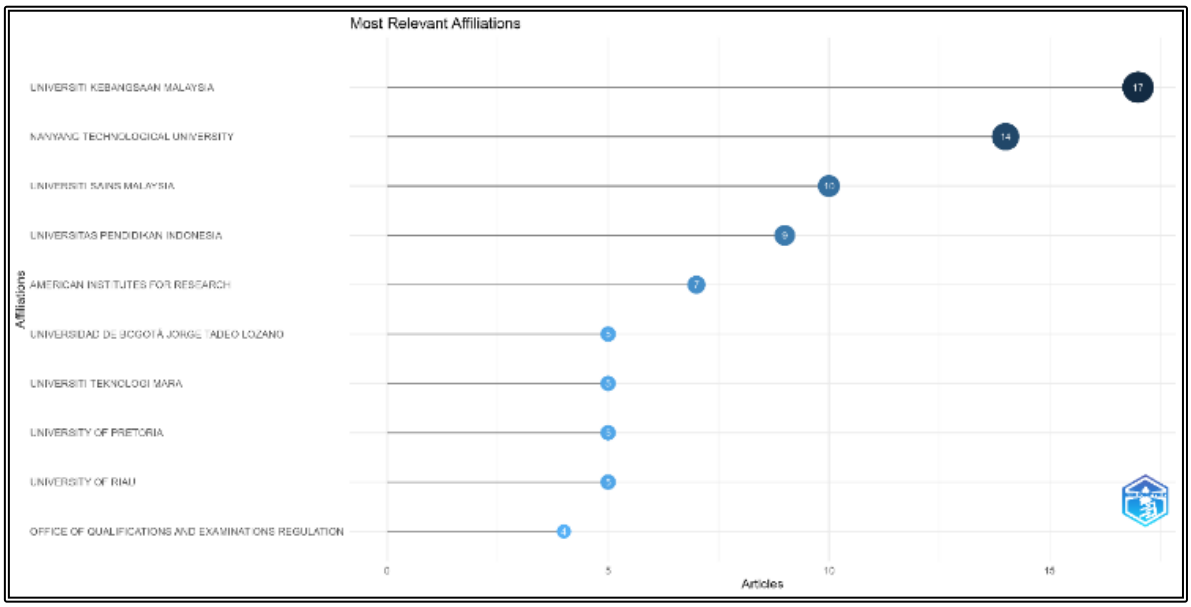

Figure 3. Most Relevant Affiliations about Utilizing Rasch Model

Figure 4 displays the frequency of articles based on their country of origin. The country with the highest frequency is Malaysia, with 104 articles, followed closely by the USA with 90 articles. Indonesia has the third highest frequency with 53 articles. This suggests that research on testing and measurement is particularly prominent in these three countries. Germany, Italy, China, South Africa, Singapore, Spain, and the UK round out the top ten countries, each with a frequency ranging from 12 to 27 articles. The presence of these countries on the list may reflect their concern in using rasch model. Overall, this table provides a snapshot of the global distribution of research on testing and measurement, highlighting the countries that are particularly active in rasch model.

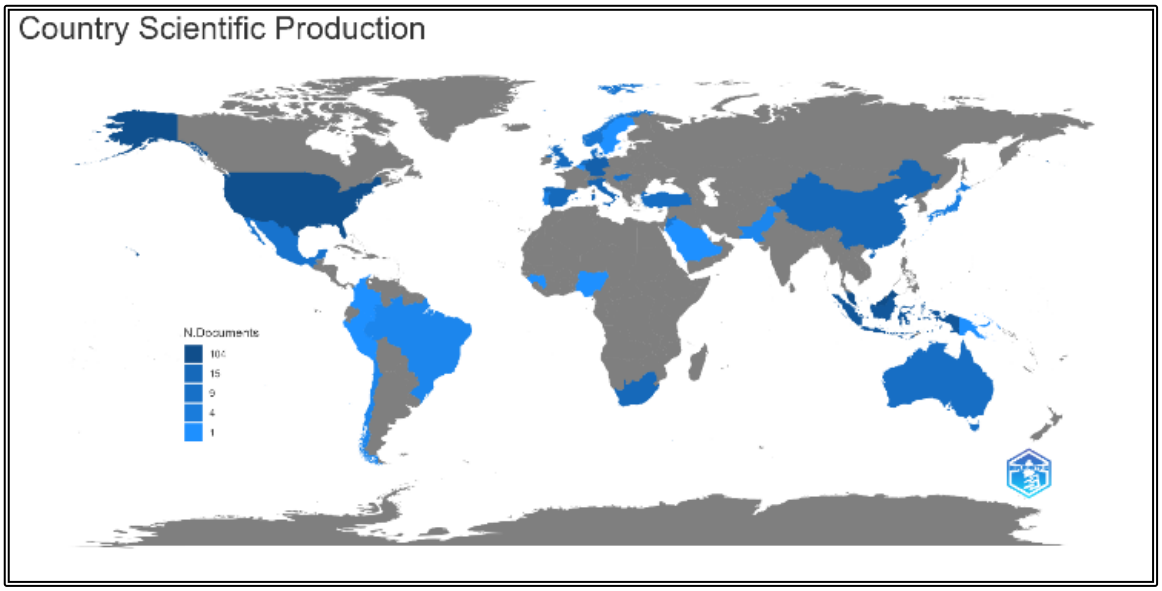

Figure 4. Country Scientific Production About Utilizing Rasch Model

Table 2 presents the top 10 most cited documents, along with their respective total citation counts. The table contains articles from a variety of fields, such as education, psychology, tourism management, and psychometrics. The most cited document is "Printy SM, 2008, Educ Adm Q" with 132 total citations, followed closely by "Clements DH, 2008, Educ Psychol" with 127 citations. The other documents have citation counts ranging from 35 to 86. The publication years of the documents range from 1995 to 2012, indicating that they have all had long-lasting impact in their respective fields. The citation counts suggest that these documents have made significant contributions to their fields of study and have been influential in shaping research and practice.

Table 2. Most Cited Document About Utilizing Rasch Model

Paper	Author	Total Citations
PRINTY SM, 2008, EDUC ADM Q	(Printy, 2008)	132
CLEMENTS DH, 2008, EDUC PSYCHOL	(Clements et al., 2008)	127
HUANG J-H, 2012, TOUR MANAGE	(Huang & Peng, 2012)	86
LAMB RL, 2012, INT J SCI MATH EDUC	(Lamb et al., 2012)	73
MARTÍN ES, 2006, APPL PSYCHOL MEAS	(Mart í n et al., 2006)	69
PRIETO G, 2003, PSICOTHEMA	(Prieto & Delgado, 2003)	63
LIU OL, 2009, APPL MEAS EDUC	(Liu & Wilson, 2009)	50
ANDRICH D, 1995, PSYCHOMETRIKA	(Andrich, 1995)	48
SMITH RM, 2003, J APPL MEAS	(Smith & Suh, 2003)	42
BARTOLUCCI F, 2011, J EDUC BEHAV STAT	(Bartolucci et al., 2011)	35

This word cloud shows the most frequently occurring terms in a dataset. The larger the word, the higher the frequency of its occurrence in the dataset. In this case, the most prominent terms are "students", "mathematics", and "education". Other terms such as "female", "male", "human", and "humans" suggest that the dataset might contain research on gender-related issues. The appearance of "Rasch modeling" in the word cloud suggests that the dataset might include research that utilizes this statistical technique to analyze data. Additionally, "education computing" suggests that the dataset might contain research that applies technology in the field of education. Overall, this word cloud provides a quick snapshot of the most prominent themes and topics present in the dataset.

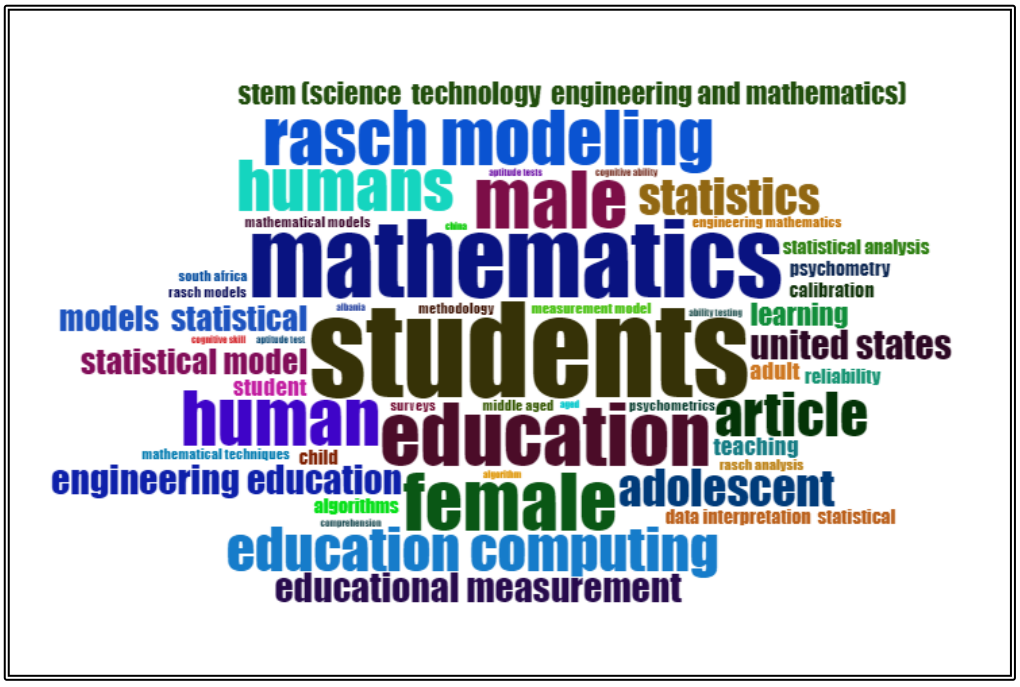

Figure 5. Word Cloud about Utilizing Rasch Model

4. CONCLUSION

This bibliometric analysis examines 159 documents from 108 sources on the utilization of the Rasch model in research publications from 1983 to 2023. The dataset includes information on document types, affiliations, publication frequency, and citation counts. The analysis shows an annual growth rate of 2.78% with an average document age of 8.35 years. The Journal of Applied Measurement is the most popular source, and Universiti Kebangsaan Malaysia is the affiliation with the most articles published. The word cloud suggests that the dataset includes research on gender-related issues, educational computing, and Rasch modeling. The analysis provides researchers with a quick way to identify the most active affiliations, top sources for potential publication opportunities, and the most frequently occurring themes and topics in this field. The top 10 most cited documents are from various fields and have significantly contributed to their respective fields of study. Overall, this bibliometric analysis provides valuable insights into the global distribution of research on testing and measurement and highlights the most influential documents, sources, and affiliations in this field.

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