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Development and Validation of Heutagogical Survey Items

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Abstract: The development of survey items includes the preparing and validating the items. A construct validity and reliability are two important concepts in survey research that are used to assess the quality of survey items. This study was conducted to generate on the construct validity process of the survey items in heutagogy elements specifically for vocational learning. Items have been developed based on relevant literature and the context of vocational education in particular leads to readiness for employment. Therefore, to go through the process of validity and reliability of the items, this study involved 100 students from Vocational Colleges to response the survey items. There are 71 items in a set of questionnaires with six elements consists of Exploring, Collaborating, Relationship, Creating, Reflection and Sharing. The data was analysed based on Rasch Model as statistical measurement model that can be used to assess the validity and reliability of research instruments. The construct validity was examined by analysing the point-measure correlation index, infit, and outfit values; meanwhile, the reliability was examined by analysing the item reliability index. The results have shown that the findings of the analysis found seven items dropped because the items did not meet the requirements of the established analysis. By analysing the data collected from the questionnaire, the final instrument shows a total of 64 items suitable for measuring six elements of heutagogy. The Rasch Model differs from other measurement models in reliability assessment by focusing on one-dimensionality, assessing both person and item reliability, enabling item calibration, and providing fit statistics. Hence, this systematic approach may facilitate researcher to improve the items to produce the good quality of research instrument.

Keywords: Construct validity, reliability, heutagogy elements, rasch model

1.   Introduction

In social science and behavioural research, survey research is a popular form of data collection. Using a standardized questionnaire, it enables researchers to directly interview people on a variety of phenomena. However, it is vital to address two important aspects: construct validity and reliability of the survey research instrument, to assure the dependability and credibility of survey findings. Validity is a measure of how well a measuring tool fulfils its purpose and relates to whether it assesses the behaviour or quality that it is designed to measure (Sürücü, L. & Maslakçı,2020), The relevant and suitable interpretation of the data obtained from the measuring device because of the analysis determines validity. Reliability is the capacity of a measurement system to yield consistent results when used at various points in time. Naturally, it is

unlikely that the same results will be obtained repeatedly due to variations in the application of the measuring instrument and modifications in the population and the sample. However, a significant positive correlation between the measurement of survey data indicates reliability (Sürücü & Maslakçı,2020). There are four types of validity of research instruments: construct validity, content validity, criterion validity and face validity. In TVET research using a quantitative approach, the items used also require a systematic validity process so that the instruments provided are of good quality to measure variables. The United Nations Organization for Education, Science and Culture (UNESCO, 2016) defines TVET as "an aspect of the educational process other than general education that involves learning in technology and science as well as training in practical skills, attitudes, understanding, and knowledge of employment in various economic sectors. and social life". Through the Economic Transformation Program (ETP), Malaysia needs a 2.5-fold increase in TVET enrolment by 2025 (Ministry of Education, Malaysia, 2015). However, the supply of TVET workers is insufficient in 10 of the 12 National Key Economic Areas (NKEA). The Twelfth Malaysia Plan 2021-2025 seeks to enhance the technical and vocational education and training (TVET) component of the national education system. The strategy calls for measures to improve graduates' employability, such as bridging programmes, upskilling and reskilling efforts, and opportunities for TVET graduates to get professional status.

Therefore, to conduct a fundamental study of the readiness of vocational students for employment, a survey on the heutagogy approach in vocational learning was conducted using a set of questionnaires as an instrument for data collection. This study explored the suitability of the Rasch Model in assessing the ability of pedagogical approach in vocational learning among vocational students. The set of questionnaires of heutagogy using a sequential strategy based on the item response model assumptions, which involves fitting the data to the model through the elimination of misfits, analysing retained items, and constructing measures. Items in the questionnaire developed based on the relevant literature should be ensured to be able to measure what needs to be measured. Thus, the validity and reliability process is carried out using the Rasch Model so that accurate measurements can be produced, and the appropriate items will be used in large-scale studies. Hence, to ensure that the questionnaire instrument has good validity and reliability, a pilot study was conducted. Next, the researcher analysed the level of validity and reliability of the questionnaire instrument with the Rasch model approach. Through this approach, the examination of each item can be done in more depth than just looking at Cronbach's alpha value alone. Through this Rasch Model approach, some in-depth analysis can be done such as checking into the functionality of each item.

2. Heutagogy Approaches

Heutagogy is a relatively new learning approach that emphasizes self-determined learning. Unlike traditional learning approaches, which are often teacher-centred, heutagogy puts the learner at the centre of the learning process. In heutagogy, learners are encouraged to take control of their own learning, set their own goals, and determine the strategies and resources they will use to achieve those goals (Seçil Tümen Akyıldız ,2019). The continuum of pedagogy, andragogy and heutagogy (PAH) describes three different approaches to teaching and learning, each with its own set of assumptions and practices. Figure 1 illustrates the continuum of PAH is not fixed or rigid and there is often overlap between the different approaches.
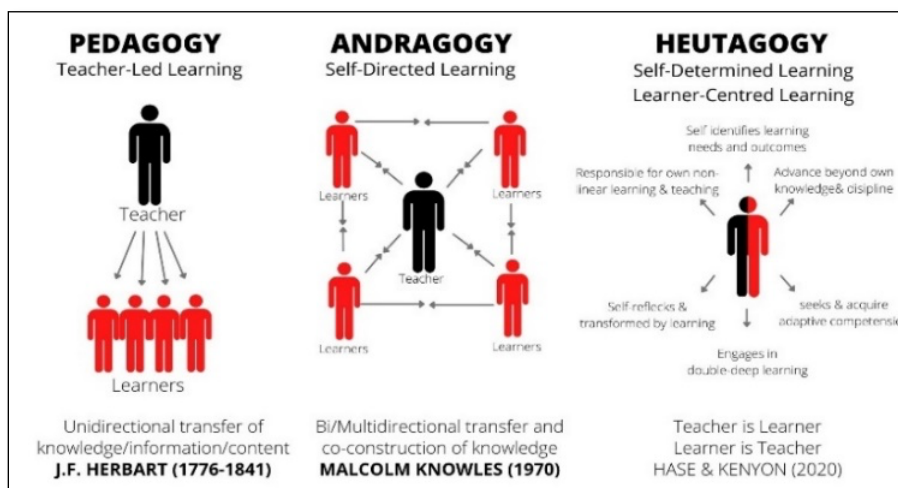

Fig. 1 - PAH Continuum (https://heutagogycop.wordpress.com/)

A learning approach that gives autonomy to students by encouraging students to choose the tendency to learn more effectively. This approach is particularly suitable in TVET learning for allowing them to be close to the actual job situation. Self-determined learning studies and a holistic approach to developing the ability of students with learning to

function as the primary agent of their own learning, which occurs because of personal experience. Students need to have competence and ability to acquire knowledge and skills and the result will make the right decision in problem-solving (McAuliffe et al., 2008; Hase & Kenyon, 2007). Some descriptions stating the principles of heutagogy are based on several literature references that have been analysed by Blashke and Hase (2016). An essential concept in heutagogy is double-loop learning (Figure 2) based on Eberle and Childress, (2005), as shown in Eberle, (2009).
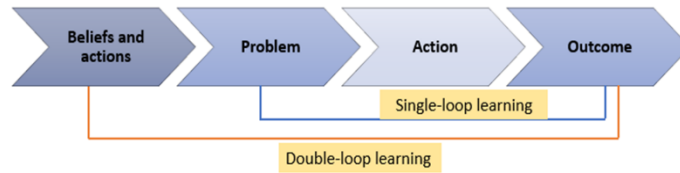
Fig. 2 - Double-loop learning

Students start to question their assumptions and gain insight into what they're learning and how they learn. Heutagogy emphasizes a learner-centred environment supporting students in defining their learning path. It also equips students with skills to help them transition into the workforce. Employers need employees to have a wide range of cognitive and metacognitive skills. Employers look for innovation, creativity, self-directedness, and whether employees understand how they learn. The principles of heutagogy to support double-loop learning are shown in Table 1.

Table 1 - Principles of Heutagogy

Principle	Description
Student-centred and self-determination	The role of the institution is fundamental to this principle. Students who are highly motivated, have authority is a primary responsibility in implementing heutagogical practice
Capabilities	Ability to produce competencies in groups self-efficacy, communication, creativity, collaboration, and value positive
Self-reflection and Metacognitive	Self -reflection is a necessity in heutagogy where students not only reflect on what is learned but a reflection on the understanding gained (metacognitive)
Double loop learning	This principle requires a relationship between psychology and behaviour. Not only does it require reflection on what learns but new knowledge and how learning affects values and beliefs
Teaching and flexible learning	Self -learning is the resulting determination by students. Therefore, students have to choose how to make that learning more meaningful

The implementation of the heutagogy approach provides a new alternative for teachers to create a more effective educational environment (Muslieah et al., 2022). Therefore, teachers should develop a better understanding and critical reflection as one of the activities in the learning process to attract students' interest and actively involve themselves. Heutagogy has six elements of heutagogy based on literature references that have been analysed by Blashke and Hase (2016). Table 2 shows the six elements of heutagogy.

2.1   Vocational Student Graduate Employability

With the development of today's world in the era of globalization, employers are not only concerned with technical skills but also knowledge and soft skills with employability so that their employees can adapt to all types of jobs and at the same time have "multi-skills" (Butcher et al., 2011). Unemployed graduates are a serious phenomenon that is happening nowadays. Labour market statistics show that the output of local institutions of higher learning is still unable to cover job vacancies even though the output of a group of workers exceeds the demand of employers. Among the main factors in the occurrence of this phenomenon is that the graduates produced are still unable to meet the needs of current employers. The necessary elements for a graduate such as technical skills, knowledge, and soft skills are essential aspects of a student's skills (Cremin Colin, 2010). The study of self-determined learning and a holistic approach to developing students 'abilities in learning serves as the primary agent of their own learning, which occurs because of personal experience (Stewart Hase & Chris Kenyon, 2007). Students need to have competence and the ability to acquire knowledge and skills and as a result will make the right decisions in problem-solving (McAuliffe et al., 2008; Hase & Kenyon, 2007). Some descriptions stating the principles of heutagogy are based on several literature references that have been analysed by Blashke and Hase (2016).

Table 2 - Elements of Heutagogy

Elements	Description	Example of learning activities	Example of learning resources and methods
Explore	Learning; create a culture of discovery and inquiry	Lecturers prepare a complex problem situation; student need to analyse the problem and propose the solution	•Report •Video •Brainstorming session
Collaborate	Work with others to build and build new knowledge and content	Lecturer asks students to identify the process and tool to repair the damage of tile floor	•Manual •Form a team member •Report
Connect	Connecting with others both inside and outside of the classroom to create new networks for supporting learning	Group discussion about method of data collection for market survey.	•Collection of questionnaires •Google document •Online platform
Create	Development of new content by building upon what has been learned	Group discussion to analyse monthly safety report in laboratory.	•Brainstorming •Framework outline •Form of presentation
Share	Sharing of new content with others in the community, showcasing, acquisition of skills and competencies	Lecturers show the video of TED Talks "Essential questions to ask your future self".	•Google document •Role play •Form of presentation
Reflect	Thinking about what has been learned and how it has been learned, as well as how this process and the new knowledge acquired influences mental models, beliefs, and values	Lecturer asks student to exchange their video presentation with peers and give comment either positive or negative	•Rubric assessment •Debate

3. The Development of the Heutagogy Research Instrument

Developing survey items for educational research requires careful consideration and planning. In this study, the first step is an analysis of pedagogical elements and a map of the need for Vocational Learning for concept identification. Next are the steps of the item construction, validity, and reliability process. A review of the literature on the development of the ability to conduct research was carried out. There were few studies of this nature. The studies on the development of research skills provide evidence on the components or construct of research to be used in this study. The review revealed that there were many components of research skills involved. A review was carried out to identify the constructs of research skills that are deemed important to conduct research. There were a range of skills necessary for research and there were different labels being used for similar constructs. After comparing and analysis of the constructs that have been identified, five constructs were selected as major or deemed important to conduct research which overlaps with several instruments. Then review and refine items to ensure they are clear, concise, and relevant to the research questions. There are various phases involved in creating questionnaire items based on a literature study. The five-phase model for the development of the questionnaire proposed by (Subahan Mohd Meerah et.al, 2012) as shown in Figure 3.

For Phase 1, according to Yaddanapudi (2019), the first step in the literature review is to determine the important ideas and variables connected to the research topic. This procedure ensures that the survey items are supported by existing theory and research. Second, conduct focus groups and/or interviews with subject-matter experts to glean additional viewpoints and ideas. Third, create a preliminary set of questionnaire items using the knowledge gained from the literature review and the advice of experts. To find any issues with the items, such as ambiguity or confusion, the questionnaire should be pilot tested with a small sample of participants. In this research, the literature matrix was used to arrange the previous research and articles in the early stage of questionnaire design. This technique can assist researchers in finding recurring themes, ideas, and variables in the literature and categorising them so that questionnaire items can be created to apply Phase 2; the operational definition of the construct and development item. By using a literature matrix, researchers can ensure that the questionnaire items are grounded in existing theory and research and that they are relevant to the research question. To develop the items, this study referred to more than thirty (30) articles related, and Table 3 describes the example of how the literature matrix design based on four articles was selected as part of the process for developing the items. The following phase was conducted when the items were developed.
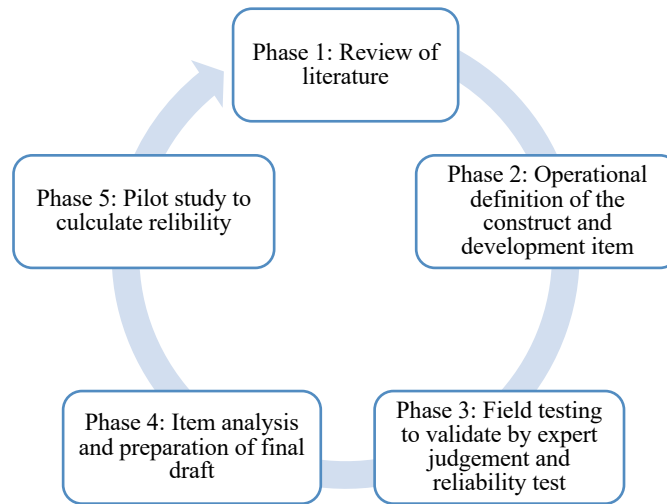
**Fig. 3 - Process of development the questionnaire items**

Table 3 - Heutagogy literature matrix

Author/Title/Year	Model/Theory/Concept	Summary
Akyildiz, S.T. (2019). Do 21st Century Teachers Know about Heutagogy or Do They Still Adhere to Traditional Pedagogy and Andragogy? International Journal of Progressive Education, 15(6), 151-169. doi: 10.29329/ijpe.2019.215.10	Extension from Hase and Canyon, from andragogy to self-determined learning	• Heutagogy, which emphasises the learner's capacity to take charge of their own learning, is an extension of andragogy, or self-directed learning. • emphasises how traditional higher education pedagogy and andragogy may not be able to match the needs of learners in the twenty-first century. • Teacher administrators in secondary school are aware of students' self-determined involvement in learning, their perspectives are examined.
Umar M. Sadjim, Ridwan Jusuf (2021). Cybergogy and Heutagogy Learning based on Ternate Local Wisdom for Elementary School Students' Character Education	Layder's research map as a framework for analysing the teacher's experiences	• Pedagogical leadership and the element of professional development in this study. • They explore how teachers can enhance their professional competence through further training and develop their pedagogical leadership skills
Blaschke, Lisa Marie (2012). Heutagogy and Lifelong Learning: A Review of Heutagogical Practice and Self-Determined Learning	Principles of heutagogy	• Strongly emphasizes the development of student competencies and their capability and capacity to learn. • Learners are encouraged to be self-directed and autonomous, take responsibility for their learning, and engage in reflective practise in a heutagogical learning environment. • Heutagogy aims to develop capable learners who can adapt to challenging environments and become lifelong learners.

Author/Title/Year	Model/Theory/Concept	Summary
Gowrie Vinayan, & Davindran Harikirishanan. (2021). Empowering Heutagogy for 21st Century Learning. *Systematic Literature Review and Meta-Analysis Journal*, 2(2), 47–52. https://doi.org/10.54480/slrm.v2i2.17	Core principle of heutagogy	• How heutagogy can benefit learners in today's rapidly globalizing economies and how technological advancements support this approach. • Heutagogical teaching and learning techniques are based on the development of each learner's individual capability, with the primary objective of preparing students to gracefully navigate the complexities of the world's rapidly globalising economies.

4.   Research Design

In the process of development questionnaires, there are phases in field testing to validate by expert judgement and reliability test, item analysis and preparation of the final draft and pilot study to measure the reliability of items (Subahan Mohd Meerah et.al, 2012). This process started to evaluate the validity and reliability of research instruments. Therefore, in the validity process, there are three experts involved in content validity, the criterion validity researchers checked all items will meet some standard in nature of vocational learning and for construct validity and reliability the survey method used involving 100 vocational students. The experts provide feedback on whether the items are relevant, comprehensive, and clear enough to measure the variables. Figure 4 describes the extended process of validity and reliability according to (Boparai, et al, 2018).
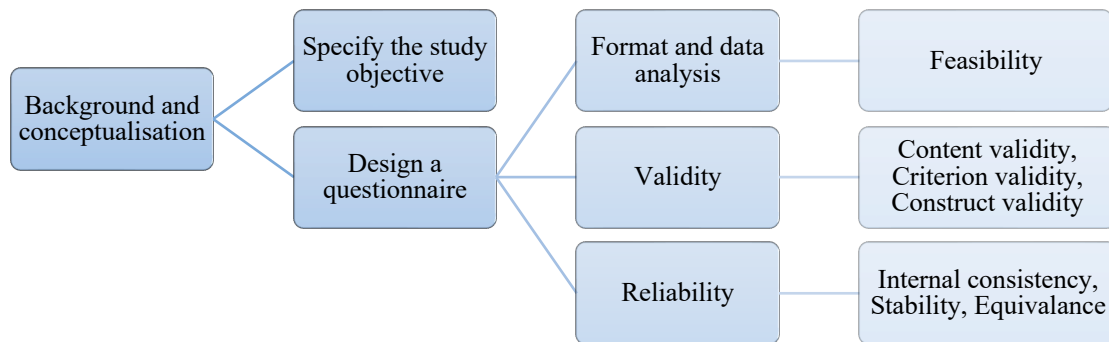
Fig. 4 - Design and validate questionnaires

The survey method with a quantitative approach was used and 100 vocational students in the southern zone enrolled on the diploma program. This survey was conducted to facilitate the process of construct validity and reliability for heutagogy survey instrument. Construct validity can be evaluated using theoretical or empirical methods, and it is established by looking at the connections between the survey items and the relevant construct (Pritha,2022). Reliability is the extent to which a survey instrument's questions consistently provide the same results when they are asked in the same context repeatedly (Yeona Jang,2020). The number of respondents in this pilot study is adequate because according to Cooper and Schindler (2011), the appropriate number of respondents in the pilot study ranged from 25 to 100 people. The survey can be administered in various ways, such as online or in person. The survey should be distributed to the identified sample, and participants should be given enough time to complete it. In this research, researchers administrative the data collection using an online platform (Google Forms) to achieve the aim of the research. This research explored the suitability of the Rasch Model in assessing the ability of heutagogical approach in vocational learning among vocational students. The set of questionnaires of heutagogy using a sequential strategy based on the item response model assumptions, which involves fitting the data to the model through the elimination of misfits, analysing retained items, and constructing measures.

4.1   Research Instrument

This study uses a questionnaire method that is divided into several sections, namely, Demographics of the study and Elements of Heutagogy. Table 4 shows, the Heutagogy element has 71 items and has 6 sub elements namely, (1) Exploring, (2) Collaborating, (3) Relationship, (4) Creating, (5) Reflection and (6) Sharing.

Table 4 - Number of items by element

Element	Sub Element	No of Item
Heutagogy	Exploring	12
	Collaborate	10
	Connection	9
	Creating	15
	Reflection	12
	Sharing	13
	Total Item	**71**

4.2   Data Analysis Method

The data analysis is based on the approach of the Rasch Model application. Rasch Model is creating a measurement tool, gathering data, fitting the Rasch Model, analysing fit statistics, analysing item and subject reliability, and analysing construct validity are the steps in validity and reliability utilised in the Rasch model. These procedures ensure that the measurement tool is valid and trustworthy for assessing the targeted construct.

5.   Result and Discussion

The researcher uses the Rasch measurement model approach to investigate item functionality from the perspectives of I, reliability, and item-respondent isolation; (ii) detecting the polarity of items measuring constructs using PTMEA CORR values; (iii) the fit of the construct measuring item; and (iv) determining the dependent items using standardised residual correlation values. The following is an explanation of each check on the item's functionality.

5.1   Reliability Index and Separation Index

Based on the Rasch measurement model approach, the acceptable value of Cronbach's Alpha (α) for its reliability is between 0.71 - 0.99, where it is at the best level (71% - 99%) described as in Table 5 (Bond & Fox 2007).

Table 5 - Interpretation of Alpha-Cronbach scores (Bond & Fox 2007)

Score (Alpha-Cronbach)	Reliability
0.9 – 1.0	Very good and effective with a high level of consistency
0.7 – 0.8	Good and acceptable
0.6 – 0.7	Acceptable
<0.6	The item needs to be repaired
<0.5	Items need to be dropped

To determine the reliability of items in the instrument, statistical analysis with the Rasch measurement model approach was used to find the reliability values as well as item segregation. The findings of the analysis of the pilot study found that the reliability value obtained based on Cronbach's Alpha (α) value is 0.98 as shown in the table. Clearly showing this value means that the instrument used is in a good and acceptable condition with a high level of consistency that can be used in actual research.

Table 6 - Cronbach's Alpha (α) value

Person RAW Score-To-Measure Correlation	Cronbach Alpha (KR-20) Person Raw Score Reliability
.99	.98

The reliability and separation index of the items and respondents were also examined as part of the overall analysis of the instrument. The table displays the item reliability and separation index values, with the item reliability value being 0.86 and the item separation value being 2.50 when rounded to 3.0. The item reliability value of 0.86 indicates that it is in good condition and acceptable (Bond & Fox 2007). The item separation value is 2.50, and the value indicates scale division into three different strata. Linacre (2005) asserts that the value of good index isolation exceeds the value of 2.0.

Table 7 - Reliability index and separation index

	Reliability Index	Separation Index
Respondent	.97	5.70
Item	.86	2.50

The reliability value of the respondents was 0.97, and the separation value of the respondents was 5.70. This indicates that the respondents' reliability is very high and good. This is because Bond and Fox (2007) explained that reliability values greater than 0.8 are considered good and widely accepted. While the respondents' separation value showed a good separation value on the level of difficulty of the item, Linacre (2005) explained that a value greater than 2.0 is a good value. The item separation value obtained was 2.50 (rounded to 3.0). Linacre (2005) suggests that a value greater than 2.0 indicates good item separation. This means that the items in the instrument can differentiate between at least three different strata of the construct being measured. Respondent Separation: The respondent separation value was 5.70, which is significantly higher than 2.0, indicating excellent respondent separation. This implies that the instrument can effectively differentiate between respondents with different levels of the construct, and it is well-suited for distinguishing between individuals with varying abilities or characteristics related to the construct. Overall, based on the findings from the Rasch measurement model approach, the instrument appears to be in good condition and acceptable for measuring the intended construct. The high reliability and separation values for both items and respondents suggest that the instrument is consistent, reliable, and capable of distinguishing between different levels of the construct. These results provide evidence that the instrument has sound psychometric properties and can be used effectively in actual research.

5.2   Item Polarity

The purpose of examining the Point Measure Correlation (PTMEA, CORR) to detect the polarity of the item is to determine the extent to which the construct's construction achieves its goal. If the value found on the PTMEA CORR section is positive (+), the item measures the construct to be measured (Bond & Fox 2007). If the value is negative (-), the developed item does not measure the construct being measured. The item must then be corrected or dropped if it does not lead to a question (is not focused) or is difficult for the respondent to answer. According to the findings, all items have a positive value, indicating that the item measures the construct to be measured (Bond & Fox, 2007)

5.3   Item Fit

The fit (fit) of items in the measuring constructs can be seen through the infit values of MNSQ and MNSQ outfits. According to Bond and Fox (2007), the MNSQ and infit MNSQ outfit values should be in the range between 0.6 to 1.4 to ensure that the items developed are suitable for measuring constructs. However, the MNSQ outfit index needs to be given attention first rather than infit to determine the matching of items that measure a construct or latent variable (Kashfi, 2011). If the MNSQ value is more than 1.4 logits, then it gives the meaning of a confusing item. If the MNSQ value is less than 0.6 logit, it indicates that the item is too easily expected by the respondent (Linacre, 2007). Moreover, the outfit values of ZSTD and infit ZSTD should also be in the range of 2 to +2 (Bond & Fox, 2007), however, if the outfit values and infit MNSQ are accepted, the ZSTD index can be ignored (Linacre 2007). Based on the table, it was found that there were 7 items that were not in the set range, and they needed to be purified or dropped. Items that exceed the value of 1.40 in the MNSQ outfit space are (1.67-H2), (1.57-H6), (1.59-M4), (1.54-BK1), (1.49-B6), (1497-BK5), (1.46 -M6). While no item whose value is less than 0.6. So, from this diagnosis, there are 7 items that need to be dropped after discussion by looking at the needs of the researcher and the views of experts.

Table 8 - Item fit based on MNSQ value

Item No	Outfit MNSQ	PTMEA CORR
H2 – Connection	1.67	A .53
H6 – Connection	1.57	B .47
M4 – Create	1.59	C .43
BK1 - Sharing	1.54	D .56
B6 - Collaborate	1.49	E .60
BK5 - Sharing	1.49	F .56
M6 - Create	1.46	G .55

5.4   Distribution of Item Difficulty Levels and Respondents' Ability

A map of item difficulty and respondent ability is utilised to determine if the administered test or instrument is suitable for the sample's ability or fulfils the objective to Bond and Fox (2007). It can clearly describe the distribution of items and respondents and can show the difference in student perception on each construct. To display item and respondent maps, the variable maps column is as shown in the following diagram. The item/respondent map indicates, based on the

results of the presented study, all items can be agreed upon, or that it is simple for respondents to give their consent. However, the distribution of the items indicates that the level of difficulty of the items is nearly equitable, i.e., there are both difficult and straightforward items. The item's respondent map suggests that all items can be agreed upon by the respondents. This means that participants in the study found it feasible to respond to all the items presented in the test or instrument. This is a positive indicator of the suitability of the items for the sample's ability level, as it shows that the respondents did not encounter any insurmountable difficulties in understanding and answering the questions. The distribution of item difficulty levels indicates that the test contains both difficult and straightforward items. This balance in difficulty is important for assessing respondents across a wide range of ability levels. It ensures that the test is not skewed towards either too easy or too challenging items, providing a more accurate and comprehensive evaluation of the respondents' abilities. The results suggest that the administered test or instrument is suitable for the sample's ability level. The fact that all items received agreement from the respondents indicates that the test was well-designed and appropriately targeted the participants' cognitive capabilities. This enhances the validity of the test's results and increases the confidence in drawing meaningful conclusions from the data. Overall, the item/respondent map provides valuable information about the suitability of the administered test or instrument, the distribution of item difficulty levels, and variations in student perceptions of each construct. These insights contribute to the overall validity and reliability of the assessment, enabling researchers and educators to make more informed decisions based on the results obtained.
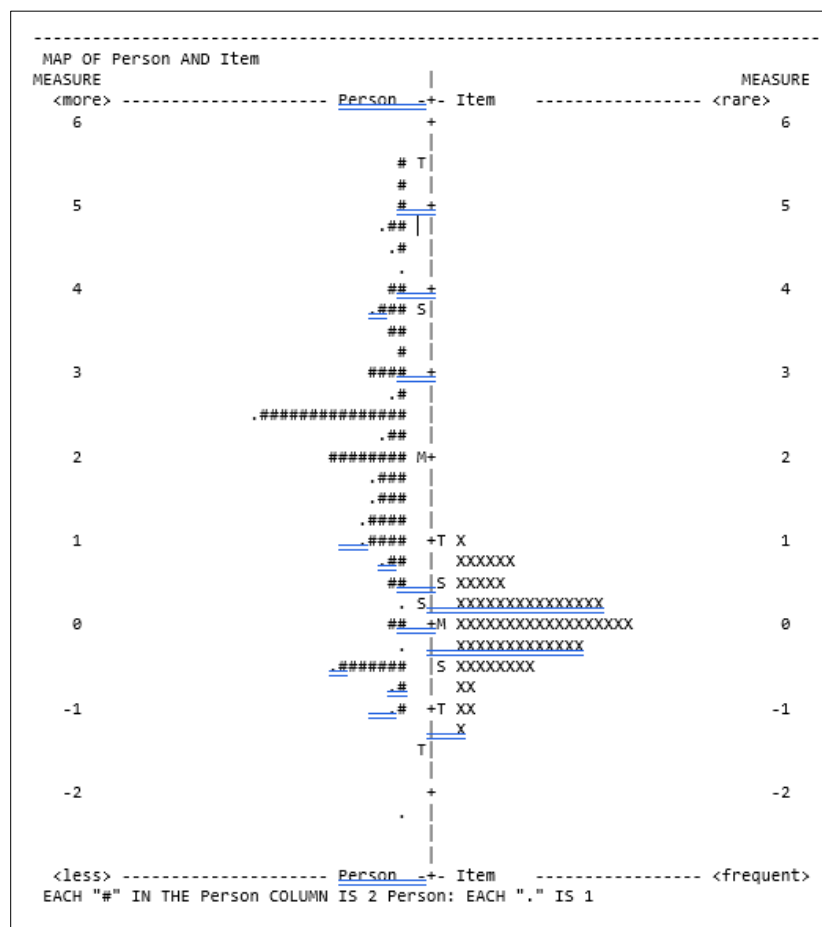
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MAP OF Person AND Item
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Fig. 5 - Item difficulty levels and respondents' ability

5.5   Standardized Residual Correlation

The measurement of standardised residual correlation values can detect local dependence, i.e., whether an item leans between items. If there is a high positive correlation value, local dependence can occur. Linacre (2010) states that if the correlation value of two items exceeds 0.7, it indicates that the items are interdependent rather than singular in nature. Linacre (2010) proposed that only one item should be chosen for measurement. Furthermore, one of these items must be dropped to produce good and high-quality instruments. Item selection refers to the value of MNSQ, which will be kept close to 1.00. (Linacre, 2010). Based on the table below, all items are in the range that has correlation values which are not dependent on each other, with the results of the study displaying a range of correlation values between 0.53 and 0.65.

Table 9 - List of local item dependence.

Correlation	Item No - Construct	Item No - Construct
.65	BK9 - Sharing	BK13 - Sharing
.63	B3 - Collaborate	B9 - Collaborate
.61	BK10 - Sharing	BK11 - Sharing
.60	BK2 - Sharing	BK9 - Sharing
.58	BK1 - Sharing	BK5 - Sharing
.56	BK6 - Sharing	BK9 - Sharing
.55	BK6 - Sharing	BK13 - Sharing
.54	R9 - Reflection	R11 - Reflection
.54	R9 - Reflection	BK7 - Sharing
.53	R4 - Reflection	BK7 - Sharing

5.6   Eliminated Item

Following the analysis of the data, each item was reviewed based on the index standards as well as the conditions that must be met to achieve the standard of validity and instrument reliability based on the Rasch measurement model. Removal and item refinement are accomplished by referring to and considering expert opinions and evaluations. According to the findings of the pilot study, there are 7 items that do not meet the requirements of the established analysis and should be eliminated. Besides, items with MNSQ values exceeding 1.30 are known as underfit items. These underfit items were considered confusing and will slightly disrupt the model fit. The overall question items are summarised in Table 8 below.

Table 10 - Summary of items dropped and retained

No	Construct	Maintained Item	Total Maintained Item	Delete Item	Total Delete Item
1	Exploring	MR1, MR2, MR3, MR4, MR5,MR6,MR7,MR8, MR9, MR10,MR11,MR12	12	0	0
2	Collaborate	B1, B2,B3,B4,B5,B6,B7,B8,B9,10	9	B6	1
3	Connection	H1	7	H2, H6	2
4	Creating	M6, M7,M8,M9,M10,M11,M12,M13,M14,M15	13	M4, M6	3
5	Reflection	R1, R2,R3,R4,R5,R6,R7,R8,R9,R10,R11,R12	12	0	0
6	Sharing	BK1, BK2,BK3,BK4,BK5,BK6,BK7,BK8,BK9, BK10, BK11, BK12,BK13	11	BK1, BK5	2

6.   Conclusion

Based on the study's findings, the research instrument, which is a set of questionnaires based on the heutagogy approach in vocational learning, underwent a thorough validity and reliability process using the Rasch Model approach. The aim was to ensure the accuracy and appropriateness of the measurement tool to assess the ability of vocational students in heutagogical learning. The study assessed the construct validity by examining the connections between the survey items and the relevant construct. The results indicated that the instrument has good construct validity, as all items were positively related to the construct they were designed to measure. The reliability of the research instrument was evaluated using Cronbach's Alpha, which is a measure of internal consistency. The instrument demonstrated high reliability, with a Cronbach's Alpha value of 0.98. This indicates a high level of consistency in the respondents' answers and suggests that the instrument is reliable for measuring the targeted construct. All items in the instrument exhibited positive values in the Point Measure Correlation (PTMEA, CORR) analysis. This confirms that the items effectively measure the intended construct of heutagogical survey items. The study used infit values of MNSQ and MNSQ outfits to assess the fit of the items. While most items fell within an acceptable range (0.6 to 1.4 logits), seven items showed values exceeding 1.40 and needed refinement or removal. The measurement of standardized residual correlation values revealed that all items were independent of each other, with correlation values ranging from 0.53 to 0.65. Based on the above analyses, the study dropped a total of 7 items from the questionnaire due to inadequate fit, resulting in a final set of 55 maintained items for measuring the heutagogy approach in vocational learning. In conclusion, the research instrument, after undergoing rigorous validity and reliability testing using the Rasch Model approach, has shown to be valid, reliable, and appropriate for assessing vocational students' ability in heutagogical learning. This validated instrument can now be used in larger-scale studies to gather accurate and meaningful data on the readiness of vocational students for employment through heutagogical approaches in vocational learning.

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