Item Response Theory: Psychometric Properties of Career Maturity Instruments for College Students

Arina Husna Zaini[1] and Muchammad Ainur Rofiqi[1]
[1]*Sayyid Ali Rahmatullah Islamic State University of Tulungagung, Tunlunggangung, Indonesia*
arinahusna@uinsatu.ac.id; rofiqikuliah@gmail.com

Abstract: Career maturity plays an important role in an individual's efforts to achieve a career in the future, especially for students who are about to enter the workforce. However, the facts show that colleges are struggling to assist students in supporting their career maturity due to the lack of instruments to measure career maturity that possess good psychometric properties, especially for students. Thus, this research aims to investigate the psychometric properties of the career maturity instrument derived from the modification of an existing career maturity instrument. This research employs quantitative exploratory research, where to achieve the research objectives, the researcher utilizes Item Response Theory (TRB). The sample in this study consists of final-year students, with a total of 357 respondents. Data collection was carried out using a modified career maturity instrument, consisting of 24 items that have been proven to be valid in content and reliable. The research results indicate that the career maturity instrument is valid in terms of construct, where the EFA analysis results show two factors, but only one factor is dominant. From the reliability test, the career maturity instrument has a reliability index of 0.7, which falls into the high category. The difficulty level of the career maturity instrument is generally considered good. From the perspective of individual capabilities, the career maturity instrument in this study can provide optimal information when used to measure students with below-average abilities.

Keywords: Item Response Theory; Psychometrics; Career Maturity

1 INTRODUCTION

The Director General of Higher Education (2023) through the Key Performance Indicator guidelines aims for graduates from higher education institutions to secure decent jobs. Decent jobs do not simply appear once students have completed their education at higher education institutions. However, the availability of decent jobs for students can be achieved when students are able to effectively plan their careers, which includes being aware when making career decisions as well as making realistic and consistent career choices over a long period of time. Levinson in Cheng et al., (2016) states that the ability in career selection is referred to as career maturity.

Career maturity is important for students who are currently in the process of attending college. This is due to the fact that low career maturity results in individual mistakes in making career decisions, which leads to losses in terms of learning failures, finances, and time (Marpaung & Yulandari, 2016). Asri et al., (2021) also explain that poor career maturity impacts the misalignment in students' career choices. The research by Saraswati and Ratnaningsih (2016) reinforces the findings of previous studies, which indicate that increasing competition and the narrowing job market compel students to adequately prepare themselves for the workforce. Therefore, career maturity is considered very important for every student, especially final-year students who are getting closer to the workforce.

Final-year students are typically in the age range of 18 to 25 years, which falls into the category of early adulthood (Paputungan, 2023). Regarding career maturity, individuals in early adulthood have a need to establish a career, seek identity, and develop a lifestyle (King, 2010). In addition, during early adulthood, final-year students are in the stage of specifying career preferences. Where the task in the career development stage is to determine career goals and explore the career options being pursued (Putri, 2012).

The importance of career maturity for students is inversely related to the facts on the ground. Research conducted by Widyatama and Aslamawati (2025) informs that the career maturity of final-year students is at 54%, which falls into the low category. Indasari et al., (2023) explains in her research that 20% of students experience confusion in determining their desired career. Students still feel uncertain in making career choices because they lack knowledge and a clear picture of the working world. The results of this study indicate that students do not yet have a good career plan.

Another fact based on interviews with final-year students at UIN Sayyid Ali Rahmatullah Tulungagung shows that many students have low career maturity. This is evidenced by the statements of students who are still unaware of the job fields related to the education they are currently pursuing. In addition, students acknowledge that the selection of study programs in higher education does not maturely consider the job fields and opportunities available in the market.

The issues related to the low career maturity outlined above are certainly influenced by various factors, including (1) the absence of career services for students, (2) the lack of experts in the field of guidance, and (3) the unavailability of accurate data or information regarding the objective conditions related to students' career maturity. Among these factors, one of the main causes is the lack of accurate data or information concerning the objective conditions related to students' career maturity. By understanding the objective conditions related to students' career maturity, it is hoped that policymakers in this case, higher education institutions, will be able to facilitate students regarding their career maturity. Thus, one alternative to ascertain the objective conditions of students' career maturity is by providing quality career maturity instruments.

Although there are many instruments regarding career maturity, these instruments are more focused on high school and vocational school students. In addition, existing career maturity instruments have been developed or adapted without fully considering the psychometric properties based on Item Response Theory. Therefore, based on the above description, the researcher is inspired to conduct a study titled *"Item Response Theory: Psychometric Properties of Career Maturity Instruments for College Students"*.

2 MATERIALS AND METHODS

This research aims to produce a standardized quality career maturity instrument for students using modern Item Response Theory (IRT) analysis. Therefore, this research is suitable for using a quantitative method. The research subjects are final-year students of UIN Sayyid Ali Rahmatullah Tulungagung, with a sample of 357 students selected randomly. The instrument used is a modified career maturity instrument from the Career Maturity Questionnaire (CMQ) developed by Ismail et al., (2022). The modifications made by the researchers relate to the addition of both favorable and unfavorable items in each aspect, as well as adjusting the context of the items to fit the subjects used in this study, namely students. The modified Blue Print Career Maturity Questionnaire (CMQ) can be seen in Table 1.

Table 1. Blue Print Career Maturity Questionnaire (CMQ)

No	Aspect	Original Instrument	Item Number	
			Favorable	Unfavorabel
1	Career Planning	I am always excited to participate in skill development programs.	I am excited to participate in programs (seminars, training, etc.) that support my career choices (CP1)	Attending job training will not make it easier for me to get a job (CP4)
		I have been planning several alternative paths for my future career.	I have alternative career options if my initial career plan fails (CP2)	I have no other perspective if the career I choose does not come to fruition (CP5)
		After graduating from vocational school, I have a well-thought-out plan to develop my career.	I have plans for work or further studies after graduating from college (CP3)	I do not know the short-term or long-term goals for my career moving forward (CP6)
2	Career Exploration	I am always looking for more than one job opportunity.	I am actively seeking various information related to the career I am interested in (CE1)	The only career information I know comes from friends (CE5)
		I am always looking for the job I want.	I am looking for information regarding careers from reliable sources (CE2)	
		If I receive job information, I will use that information to prepare myself for the job.	I use the information I obtain to prepare myself for achieving the career I have chosen (CE3)	It is not important for me to consider information from friends as material in determining my future career (CE6)

No	Aspect	Original Instrument	Item Number	
			Favorable	Unfavorabel
		I am discussing my career with my family, teachers, and friends.	I make my career choices based on the information I have gathered. (CE4)	
3	Decision Making	I choose my job based on my talents and interests.	I am planning my future career based on my talents and interests (DM1)	I am reluctant to discuss my career plans with my family or professors (DM4)
		I am responsible for the choices I make regarding my future career.	I am ready to take responsibility for what happens with my career choices (DM2)	I do not consider a good work environment when choosing a job (DM5)
		By attending vocational school, I have already envisioned what I will become in 5-10 years.	I can imagine what I will become in 5-10 years (DM3)	I chose my field of study because of pressure from others (DM6)
4	Self-Concept	I know my talents and interests very well.	I know my talents and interests well (SC1)	It's difficult for me to find the talent that I possess (SC5)
		I can investigate the factors that may support and hinder my career.	I am able to identify the factors that support or hinder my career (SC2)	
		I can adapt to new conditions.	I am capable of adapting to new environments (SC3)	I do not understand the condition of my career moving forward (SC6)
		To get my dream job, I will put in my best effort.	I am making maximum effort to achieve the planned career (SC4)	

The modified instrument was then validated for content validity through the stages of observation, review, evaluation, and assessment of the item's alignment with the aspects by five validators. The validators provided qualitative assessments in the form of suggestions and feedback used by the researcher to revise the items, as well as quantitative assessments where the scores given by the validators were processed and analyzed based on the Aiken V formula. The results of the analysis of the assessment of reasoning and mathematical proof items are summarized in Table 2.

Table 2. Results of Aiken V Content Validity

Aitem Number	Validity Score	Information
CP1	0,95	Valid
CP2	0,95	Valid
CP3	0,90	Valid
CP4	0,90	Valid
CP5	0,95	Valid
CP6	0,85	Valid
CE1	0,85	Valid
CE2	1	Valid
CE3	0,90	Valid
CE4	0,90	Valid
CE5	0,95	Valid
CE6	1	Valid
DM1	1	Valid
DM2	0,95	Valid
DM3	0,90	Valid
DM4	0,85	Valid
DM5	1	Valid
DM6	0,85	Valid
SC1	0,85	Valid
SC2	1	Valid
SC3	1	Valid
SC4	0,85	Valid

Aitem Number	Validity Score	Information
SC5	1	Valid
SC6	0,90	Valid

The instrument that has been proven valid in this validity is used for research with a sample of 357 respondents. The data obtained from the sample was subsequently analyzed for construct validity using Exploratory Factor Analysis (EFA). Construct validity is used by researchers to prove that the instrument measures the ability it is intended to measure (Ratnawati, 2016). Before conducting the EFA analysis, the researcher performed a sample adequacy analysis as a prerequisite test. If the sample adequacy test is met, then EFA analysis can be conducted by examining the Eigen values. The Eigen values are used as a basis for determining the factors that are formed (Ratnawati, 2016). The reliability estimation of the instrument uses Cronbach's Alpha, where the instrument is considered reliable if the reliability coefficient is greater than 0.6 (Guillford, 1956).

The analysis of the instrument's items is conducted using modern test theory, specifically Item Response Theory (IRT), on data from a polytomous Rating Scale Model (RSM). In the IRT analysis, the researcher first verifies whether the items fit the model. The suitability of the item refers to the parameters proposed by Hu & Bentler (1999), namely, Goodness of Fit (GFI > .9), Root Mean Square Error of Approximation (RMSEA < .05), Comparative Fit Index (CFI > .9), and Standardized Root Mean Square Residual (SRMR < .08). Next, the items that fit the model can continue with the analysis of the IRT equation model used, namely the one-parameter logistic model (1PL), where the researcher investigates the difficulty level of the items. An item has a good level of difficulty if it has an index of $-2 \leq b \leq +2$ (Hambleton & Swaminathan, 1985). An item is categorized as very easy or has a very low level of difficulty when the value of b approaches -2, while an item is categorized as difficult or has a very high level of difficulty when b approaches +2 (Ratnawati, 2016).

3 RESULTS

The data obtained from measurements using the Career Maturity Instrument (CMI) were analyzed using the R+ application. The first analysis began with a sample adequacy test. The adequacy of the sample can be assessed through the Kaiser-Mayer-Olkin Measure of Sampling Adequacy (KMO-MSA) with a criterion above 0.05, and by determining the presence of correlation among variables using the Bartlett test with a criterion of less than 0.05. The results indicate that each item on the career maturity instrument has a KMO-MSA > 0.05 and a Bartlett test result < 0.05. It can be said that the research data meets the sample adequacy and fulfills the requirements for further analysis or Explanatory Factor Analysis. (EFA). Analysis in EFA indicates the validity of a construct or construct validity. That assumption will be met if an instrument measures only one dominant dimension, namely the same ability (Hambleton & Swaminathan, 1985). The results of the EFA analysis can be seen in Table 3.

Table 3. Explanatory Factor Analysis

	MR1	MR5	MR7	MR2	MR6	MR3	MR4	MR8
SS Loading	1.77	1.14	1.09	1.04	0.98	0.94	0.84	0.57

Based on Table 4, it shows that the career maturity instrument has 8 factors. However, despite the presence of these 8 factors, there is one dominant factor, which has an eigen value coefficient close to 2. Therefore, it can be said that the career maturity instrument meets construct validity with AFE. The visualization of the AFE results can be seen in the following image.

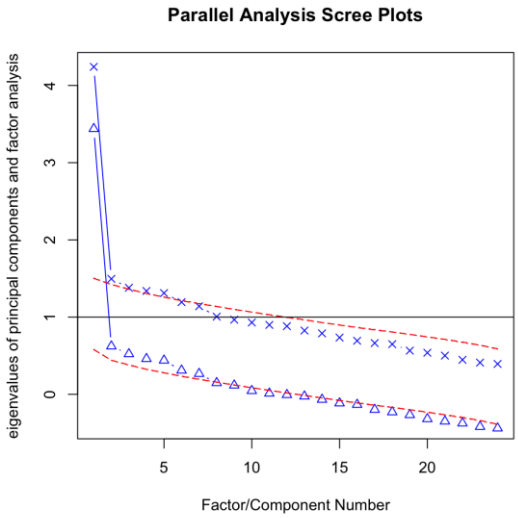

Image 1. Scare Plot Eigen Value

The Scree Plot in Figure 1 shows that there is one slope between factor 1 and factor 2, while the distance from component 2 to the next component begins to flatten out. This indicates that there is 1 dimension/factor in the career maturity instrument, thus it can be used as a basis that the career maturity instrument meets unidimensionality. The suitability of an item is an index or indicator that determines whether an item meets the requirements to be a good measuring tool and functions optimally. Here are the results of the item fit test.

Table 4. Item Compatibility

No	Indicator	Coefisien
1	Comparative Fit Index (CFI)	0,817
2	Tucker-Lewis Index (TLI)	0,759
3	Root Mean Square Error of Approximation (RMSEA)	0,05
4	Standardized Root Mean Square Residual (SRMR).	0,054

Table 4 informs that the CFI and TLI coefficients are high, approaching 0.9, while the RMSEA and SRMR values are low, close to 0.06 or 0.08, indicating that the career maturity instrument items fit the model, allowing for IRT analysis to be conducted.

The difficulty level of an item is represented by bi and is expressed in logit units. The items have a good level of difficulty if they have an index of $-2 < b < 2$ (Hambleton & Swaminathan, 1985). Items are categorized as very easy or having a very low level of difficulty when the bi value approaches -2, while items are categorized as difficult or having a very high level of difficulty when b approaches +2 (Ratnawati, 2016). The results of the analysis of the difficulty level of the career maturity instrument are presented in Table 5.

Table 5. Difficulty Index

Item Number	Difficulty Index	Category
CP1	-1.4521	Currently
CP2	-1.1812	Currently
CP3	-1.4553	Currently
CP4	-1.2290	Currently
CP5	-1.3056	Currently
CP6	-1.1189	Currently
CE1	-1.2686	Currently
CE2	-1.2977	Currently

Item Number	Difficulty Index	Category
CE3	-1.2016	Currently
CE4	-1.6833	Currently
CE5	-0.8721	Currently
CE6	-1.1715	Currently
DM1	-1.3756	Currently
DM2	-1.2755	Currently
DM3	-1.0779	Currently
DM4	-0.9431	Currently
DM5	-1.1342	Currently
DM6	-1.1194	Currently
SC1	-1.1270	Currently
SC2	-1.0235	Currently
SC3	-1.5789	Currently
SC4	-1.2951	Currently
SC5	0.1571	Currently
SC6	-0.8482	Currently

Table 5. informs that 24 items of the career maturity instrument fall into the moderate difficulty category. Although all items are in the moderate category, the difficulty index of each item varies greatly. According to Arifin (2017), a good instrument can be seen from the item difficulty index, where a set of items has a diversity of item difficulty levels.

According to Azwar (2015) the item discrimination power is the extent to which an item can differentiate between instruments or groups of individuals who possess and do not possess the attributes being measured. The results of the analysis of the differential power of the career maturity instrument are presented in Table 6.

Table 6. Analysis Of Differential Power

Item Number	Index Of Differential Power	Category
CP1	1.6273	Less Good
CP2	1.2043	Less Good
CP3	1.3759	Less Good
CP4	0.6710	Less Good
CP5	1.0283	Less Good
CP6	0.7288	Less Good
CE1	2.0052	passable
CE2	2.5731	passable
CE3	3.1318	Good
CE4	1.0781	Less Good
CE5	0.8802	Less Good
CE6	1.6414	Less Good
DM1	1.7258	Less Good
DM2	2.9772	Good
DM3	0.6438	Less Good
DM4	0.9221	Less Good
DM5	1.5421	Less Good
DM6	1.7564	Less Good
SC1	0.7940	Less Good
SC2	1.5768	Less Good
SC3	1.2514	Less Good
SC4	2.3872	Good
SC5	0.3891	Less Good
SC6	0.7167	Less Good

Table 6 informs that 24 items of the career maturity instrument have varying categories of discrimination power. 3 items fall into the good category and 21 items fall into the less good category. Meanwhile, the reliability of the instrument indicates the consistency of measurement results on the same object. The reliability value of the instrument is indicated by the reliability coefficient, which ranges between $-1.00 < p < 1.00$. The reliability coefficient of the career maturity instrument for students is presented in the table below.

Tabel 7. Reliability

No	Method	Reliability Coefficient
1	Cronbach's Alpha	0,7

Table 7 informs that the reliability coefficient of the student career maturity instrument is 0.7, which is close to 1. This aligns with the opinion of (Nunnally & I.H, 1994) that a good reliability index falls between 0.7 and 0.9.

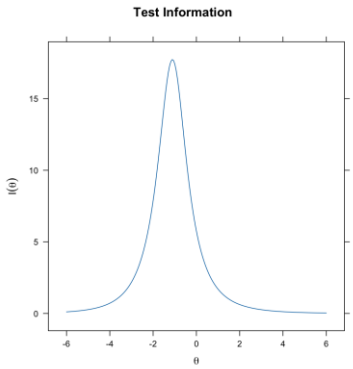

Image 2. Test Information Fungsion

Image 2. provides information regarding the Career Maturity Information Function Test (TIF), indicating that the maximum value of the information function of the instrument is greater than 15, which is found in students with an ability level of approximately -1.3. This can be interpreted to mean that the instrument will provide the greatest information with the smallest standard error of measurement (SEM) when administered to subjects with a theta ability level of $\theta = -1.3$. Conversely, when the career maturity instrument is administered to students with high ability or those with $\theta > 0$, the information provided by the instrument will be minimal or not optimal, which also results in lower reliability of the instrument.

4 DISCUSSIONS

The construct validity of the career maturity instrument was tested on a sample of 357, specifically final-year students at UIN Sayyid Ali Rahmatullah Tulungagung. The sample responses provided on the career maturity instrument were administered and analyzed based on Item Response Theory (IRT) using the R application. Based on the research findings, it is known that the career maturity instrument has a good construct. A good construction of the student career maturity instrument is evidenced by the items of the instrument that have been modified according to the theoretical constructs, the context of the research subjects, and the assessment from validators. In addition, good contract evidence can also be seen from the results of the Exploratory Factor Analysis (EFA), which shows that the career maturity instrument is proven to be unidimensional and can be interpreted that the career maturity instrument accurately measures the career maturity of students. The level of difficulty is one of the indicators to assess the quality of an item. The analysis results using TRB indicate that the overall career maturity items have a difficulty level that tends to be moderate. Therefore, it can be said that this instrument is suitable for measuring the career maturity of students. This is supported by Arifin (2017), who states that a good instrument can be seen from the item difficulty index, where in one set of items there is a diversity of item difficulty levels.

The reliability of an instrument indicates the consistency of that instrument. The reliability of an instrument is generally expressed numerically in the form of a coefficient ranging from -1 to +1 (Ratnawati, 2016). Azwar (2015) states that the level of a reliability coefficient cannot be answered with a definite number. However, the larger the reliability coefficient, the more consistent the instrument will be when used repeatedly (Khumaedi, 2012). Ratnawati (2016) also states that a high coefficient indicates high reliability, and if a reliability is perfect, it means the test has a coefficient of +1 or -1. Based on the trial results, the reliability coefficient of the career maturity instrument is 0.7. This reliability coefficient can serve as a basis to state that the career maturity instrument can be considered reliable. This finding is supported by Basuki & Haryanto, (2014); Surapranata, (2009) stating that a reliability coefficient is considered reliable if it is above 0.5. Widodo (2006) also states that a reliability coefficient above 0.5 is already satisfactory. A satisfactory reliability coefficient can be interpreted as reliable. The reliability coefficient is close to 1, indicating that the career maturity instrument has high reliability. This high reliability suggests that the developed career maturity instrument possesses

consistent characteristics, meaning that the measurement results obtained are stable and show minimal error in achieving measurement outcomes (Ratnawati, 2016).

The item discrimination index shows how well an item can differentiate between subjects with high and low abilities/traits. The modern theory of item discrimination is used to determine at what ability/trait level the items function well. In this study, the item discrimination power obtained indicates that 19 items are poor, 2 items are fair, and 3 items fall into the good category. This result confirms the findings that the developed items tend to be multidimensional or measure heterogeneous attributes. This is reinforced by what Widhiarso (2010) stated, that in a measurement, if many items are discarded or have poor discriminative power, it could be due to the fact that the developed items are multidimensional measurements. Furthermore, the low discriminative power of the items also indicates that the developed items are ambiguous or not aligned with the characteristics of the subjects, thus the wording of the items should be improved (Hasanah & Zaini, 2023).

5 CONCLUSIONS

Based on the results of the analysis and research that have been completed, it can be concluded that the career maturity instrument that has been developed has positive results in two primary areas. First of all, the instrument's construction aligns with the underlying theory, suggesting that the instrument can adjust calibration as expected in theory calculations. Furthermore, this instrument is reliable, which means that the results of the corrections made with it are consistent and can be trusted to be used in longer-term research or practical application. This also has two primary implications regarding the development of career maturity instrumentation. First, the completed instrument can be used as a tool for measuring student loan repayment amounts, allowing related institutions to obtain useful information on their students' loan repayment amounts. Furthermore, it is recommended to conduct further research on the sample preparation technique in order to reconsider the instrument's construction. Although construction is generally sound, it should be noted that there are a few items with rather uneven surfaces, necessitating more thorough inspection.

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