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Promoting Sustainable Career Development in Inclusive Education: A Psychometric Study of Career Maturity Among Students with Special Educational Needs †

Fengzhan Gao [1,2], Lan Yang [1,3,4,*], Lawrence P. W. Wong [5], Qishuai Zhang [3], Kuen Fung Sin [1,2,*] and Alessandra Romano [6]

1 Institute of Special Needs and Inclusive Education (ISNIE), The Education University of Hong Kong, Tai Po, Hong Kong, China; fzgao@eduhk.hk
2 Department of Special Education and Counselling, The Education University of Hong Kong, Tai Po, Hong Kong, China
3 Department of Curriculum and Instruction, The Education University of Hong Kong, Tai Po, Hong Kong, China; s1147050@s.eduhk.hk
4 Analytics\Assessment Research Centre (ARC), The Education University of Hong Kong, Tai Po, Hong Kong, China
5 School of Educational Psychology & Counselling, Monash University, Melbourne 3800, Australia; lawrence.pw.wong@gmail.com
6 Department of Social, Political and Cognitive Sciences, University of Siena, 53100 Siena, Italy; alessandra.romano2@unisi.it
* Correspondence: yanglan@eduhk.hk (L.Y.); kfsin@eduhk.hk (K.F.S.)
† This article is a revised and expanded version of a paper entitled "Enhancing Career Development Assessment for SEN Students: Psychometric Validation of the Career Maturity Inventory, which was presented at the American Educational Research Association Annual Meeting 2025, Denver, CO, USA, 23–27 April 2025 [1].

Abstract

Despite progress in inclusive education, students with Special Educational Needs (SEN) often lack valid, tailored tools for career assessment, limiting equitable transitions to adulthood and employment. Closing this gap is crucial for Sustainable Development Goal 4 (SDG 4), which calls for quality and inclusive educational opportunities. This study addresses this need by adapting and validating a 16-item Career Maturity Inventory-Form C (CMI-C) for Chinese post-secondary SEN students (n = 34) in vocational training in higher education. Rasch modeling, supported by exploratory factor analysis, indicated that a two-factor structure—'career choice readiness' and 'intention to seek career consultation'—provided the best fit to the data, rather than the originally hypothesized four-factor model. The results were more consistent with a two-dimensional structure than with prior four-factor frameworks, though both were explored. Two poorly performing items were removed, resulting in a fourteen-item scale with acceptable item fit and reliability indices in this hard-to-reach group. This restructuring suggests constructs such as concern, confidence, and curiosity are closely linked in SEN populations, underscoring the value of context-sensitive assessment. The revised instrument demonstrated satisfactory model fit and internal consistency; however, convergent validity and practical utility should be interpreted cautiously given the modest sample size. While further validation in larger and more diverse samples is warranted, this study offers preliminary evidence for an adapted, inclusive assessment tool that aligns with SDG 4's aim to promote equity and empower SEN students in educational and career pathways.

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1. Introduction

Achieving inclusive and equitable quality education, as outlined in Sustainable Development Goal 4 (SDG 4), is a critical priority in many Asian societies, yet students with Special Educational Needs (SEN) continue to face significant challenges in preparing for their future careers. Career planning is a vital developmental task during adolescence, but SEN students often encounter additional cognitive, social, and environmental barriers [2]. These may include developmental delays, limited access to specialized resources, and fewer opportunities for personalized guidance, all of which complicate their career decision-making process. Although global research demonstrates that students actively seek teacher support for career planning [3–5], disparities in the quality and availability of career guidance for SEN students persist, particularly in rapidly changing educational environments in Asia [6,7]. Specifically, Hearne and Neary [6] compared secondary school career guidance models in Ireland and England, finding significant variation in how guidance is provided and the degree to which it is integrated into the school curriculum. They highlight the challenges schools face in embedding holistic career and life development (CLD) within the curriculum, citing disparities in students' access to social and cultural capital, and emphasize the need for systemic educational change and professionalisation of staff to support more equitable and embedded guidance services. Wong et al. [7] showed that, while technology holds promise for expanding access to career and life planning education in Hong Kong, practical disparities persist. They found that, even with limited budgets and staff untrained in advanced technologies, schools can leverage commonly available and affordable technology to support student career exploration but also found that uneven implementation and resource constraints may limit benefits for some students. These studies underscore the ongoing structural and resource-related disparities in career guidance provision across educational contexts.

Despite increased attention to inclusive education, a critical gap remains: the lack of robust, validated tools to accurately assess career choice readiness and inform targeted interventions for SEN students. These challenges underscore the urgent need for tailored interventions and robust assessment tools that accurately capture the unique career development profiles of SEN students, in line with the inclusive vision of SDG 4. Career maturity—reflecting an individual's readiness to make informed, age-appropriate career decisions—is widely recognized as a key outcome for effective career interventions [8]. However, established models and measurement instruments, including the widely used Career Maturity Inventory-Form C (CMI-C) [9], were primarily developed for typically developing populations [10–15] and may not fully address the developmental profiles or contextual needs of SEN learners.

In particular, the theoretical framework advanced by Savickas and Porfeli [9] explicitly conceptualizes the CMI-C as a measure of career choice readiness (career maturity) by operationalizing the core dimensions of concern, control, curiosity, and confidence. This approach is especially relevant for youth navigating complex and uncertain transitions, such as those with SEN. Empirical studies have shown that higher career maturity is associated with improved career self-efficacy, self-concept, and problem-solving skills [16–18]. Moreover, a positive association between career maturity and quality of life has been observed [19,20], although this relationship remains underexplored among SEN populations.

Therefore, this study is designed to directly address these gaps by adapting and validating the CMI-C among SEN students enrolled in a post-secondary training programme in Hong Kong. The rationale for this work is grounded in the urgent need to provide empirically sound and contextually relevant assessment tools for a rapidly growing and under-researched group. By offering a validated measure and initial evidence on its correlations, this research aims to equip educators and practitioners with practical tools for supporting career development and decision-making among SEN learners. While modest in scale, this study offers timely and contextually relevant insights that support the ongoing operationalization of SDG 4 in the Asian context, helping to bridge persistent gaps between inclusive policy aspirations and actual practice.

2. Theoretical Foundation of Career Maturity

Originally conceptualized as "vocational maturity" by Super [15,21], career maturity refers to an individual's readiness to make informed, age-appropriate career decisions and cope with related challenges. Although definitions vary, it broadly involves making realistic career choices over time, using personal and contextual knowledge [22–24]. Super [24] proposed that career maturity develops in stages, reflecting an individual's ability to meet evolving expectations throughout the vocational lifespan.

Crites [10–12] further refined the concept, highlighting two core dimensions: an attitudinal component (feelings and dispositions about career choices), and a cognitive component (decision-making skills and effective use of information) [14]. This dual approach underscores both the emotional and intellectual aspects of career decision-making.

3. Literature Review

3.1. Early Measurement Efforts in Career Maturity

As previously stated, early efforts to measure career maturity emerged from foundational work by Super [15] and the subsequent development of the Vocational Development Inventory by Crites [10]. These seminal studies established that career maturity reflects an individual's preparedness to make informed and practical career decisions by integrating cognitive skills with affective attitudes. Building on this foundation, Crites' development of the Career Maturity Inventory (CMI) provided a widely used and validated measure of career maturity [25,26].

Over time, scholars recognized the need to update career maturity measures to reflect evolving career pathways and the increasing complexity of career development. The traditional CMI, while robust, was primarily developed for typically developing populations and did not fully capture the dynamic and adaptive aspects of contemporary career behavior. To address this, Crites and Savickas [13] advocated for integrating new theoretical perspectives into career maturity measurement.

In response, Savickas and Porfeli [9] introduced the Career Maturity Inventory-Form C (CMI-C). This instrument advanced the field by incorporating career adaptability—a construct reflecting psychosocial readiness and coping abilities in the face of job transitions and workplace challenges [27,28]. The CMI-C measures four dimensions: concern, curiosity, confidence and consultation. Each dimension represents adaptive resources that enhance preparedness for occupational choices.

Despite these advances, most validation studies have focused on mainstream populations, leaving a critical gap regarding the adaptation and validation of such measures for students with Special Educational Needs (SEN). SEN students often face additional cognitive, social, and environmental barriers [2] that may not be adequately addressed by instruments designed for the general population. Given these challenges, it is important to

examine whether a refined measure like the CMI-C can reliably assess career maturity in the SEN context.

3.2. Correlations and Predictors of Career Maturity

Recent empirical research has shifted from classic models toward evaluating a wider range of correlations and predictors of career maturity. While early foundational work established the theoretical basis for career development, contemporary studies emphasize how career maturity is associated with constructs such as career self-efficacy, self-concept, and life skills across different educational contexts [16–18,29,30]. For example, higher career maturity has been linked to greater self-efficacy and an internal locus of control among Chinese adolescents [17], and to improved problem-solving and career commitment among South African students [18]. In Hong Kong, positive associations have been observed between career maturity and life skills development, including among students with Special Educational Needs [29,30].

Furthermore, career maturity is increasingly recognized for its role in student well-being. Research indicates that career maturity can mediate the effects of perceived marginalization on mental health in young adults [31], while occupational self-efficacy mediates the relationship between psychological separation and career maturity [32]. Additional studies highlight the importance of professional self-concept and psychological resilience in supporting career maturity within specialized groups, such as nursing students [33]. These contemporary findings reinforce the centrality of career maturity to students' overall development and adaptability [34]. Nevertheless, there remains a significant need to extend and validate these associations within more diverse and under-researched populations—particularly among students with Special Educational Needs—to ensure that assessment instruments are robust and sensitive to their unique educational challenges.

3.3. Career Maturity and Life Satisfaction

While the "Correlates and Predictors of Career Maturity" section above focuses on the antecedents and factors that shape career maturity, this section extends the discussion by examining how career maturity influences broader quality of life outcomes.

According to the APA Dictionary of Psychology, life satisfaction is defined as "the extent to which a person finds life rich, meaningful, full, or of high quality" [35]. Although relatively few studies have directly examined the relationship between career maturity and life satisfaction, emerging evidence suggests a positive association between these constructs among young people. For instance, Ham and Lim [19] used longitudinal panel data from 224 Korean middle school students to evaluate the effects of a short-term career exploration programme. Their cross-lagged analysis revealed that higher career maturity at pre-test significantly predicted increased school satisfaction at post-test, indicating a potential causal link between enhanced career decision-making abilities and improved quality of life. Similarly, Parola and Marcionetti [20] found that among 513 Italian students, career indecision was negatively related to life satisfaction, with career adaptability serving as a mediating factor. These findings suggest that mature career decision-making and adaptive coping strategies may contribute to higher life satisfaction, highlighting the importance of addressing career-related challenges as part of broader well-being interventions. This line of research underscores the need for further investigation into how career maturity can serve as a buffer against the negative impacts of career indecision on overall quality of life, particularly in diverse populations.

3.4. The Present Study: Advancing SDG 4 Through Inclusive Career Assessment

Building on the theoretical and empirical foundations reviewed above, this study directly addresses Sustainable Development Goal 4 (SDG 4) by seeking to improve the

quality and inclusivity of educational and career support for students with Special Educational Needs (SEN). SDG 4 aims to "ensure inclusive and equitable quality education and promote lifelong learning opportunities for all" [36], emphasizing the removal of barriers for marginalized learners and the development of relevant life skills.

Despite significant progress in policy and advocacy for inclusive education, there remains a critical need for validated, context-sensitive tools that can accurately assess career maturity and inform interventions for SEN populations [4,37,38]. Most existing measures, including the widely used CMI-C, have been validated primarily among typically developing students and may not adequately capture the complex career decision-making processes or unique needs of SEN school leavers.

The present study therefore aims to (1) validate the adapted CMI-C for use with Chinese SEN students in post-secondary vocational training; (2) examine its factor structure, reliability, and relationship with life satisfaction; and (3) profile subgroups for differentiated support. By providing a psychometrically sound and practically useful assessment tool, this research contributes to both the empirical literature and the operationalization of SDG 4. The findings will help practitioners design evidence-based, tailored interventions that empower SEN students to make informed career decisions and pursue meaningful educational and employment pathways—fulfilling the core vision of sustainable, inclusive education.

4. Materials and Methods

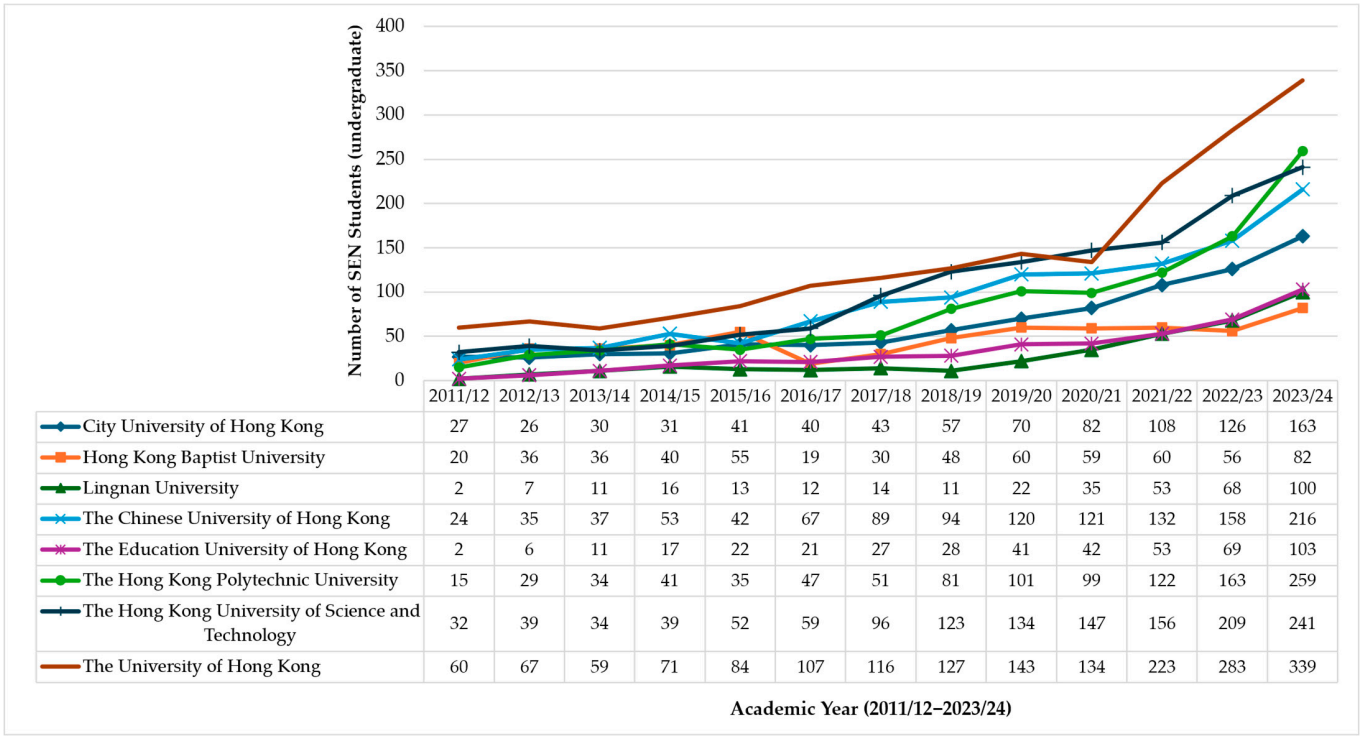
4.1. Current Study

4.1.1. Scope, Objectives, and Hypotheses of the Current Study

While the CMI-C [9] has advanced the measurement of career maturity by integrating career adaptability, it remains largely unvalidated for students with Special Educational Needs (SEN), a group facing unique developmental and contextual challenges in career planning [2]. Existing tools, developed for typically developing populations, may not adequately reflect the career decision-making processes of SEN students. The present study aimed to validate the adapted Career Maturity Inventory-Form C (CMI-C) for a cohort of school leavers with Special Educational Needs (SEN) enrolled in a post-school higher education training programme. Specifically, we sought to (1) examine the construct validity and reliability of the adapted CMI-C through exploratory factor analysis and Rasch modeling; (2) evaluate the measurement model fit and dimensionality by comparing alternative structural models; and (3) investigate criterion-related validity by examining associations between career maturity dimensions and students' life satisfaction. These objectives were designed to establish a robust evidence base for using the adapted CMI-C within this unique population. By addressing these understudied areas, the present study seeks to fill critical gaps in the literature, offering both theoretical insights and practical tools to enhance career planning interventions for SEN students.

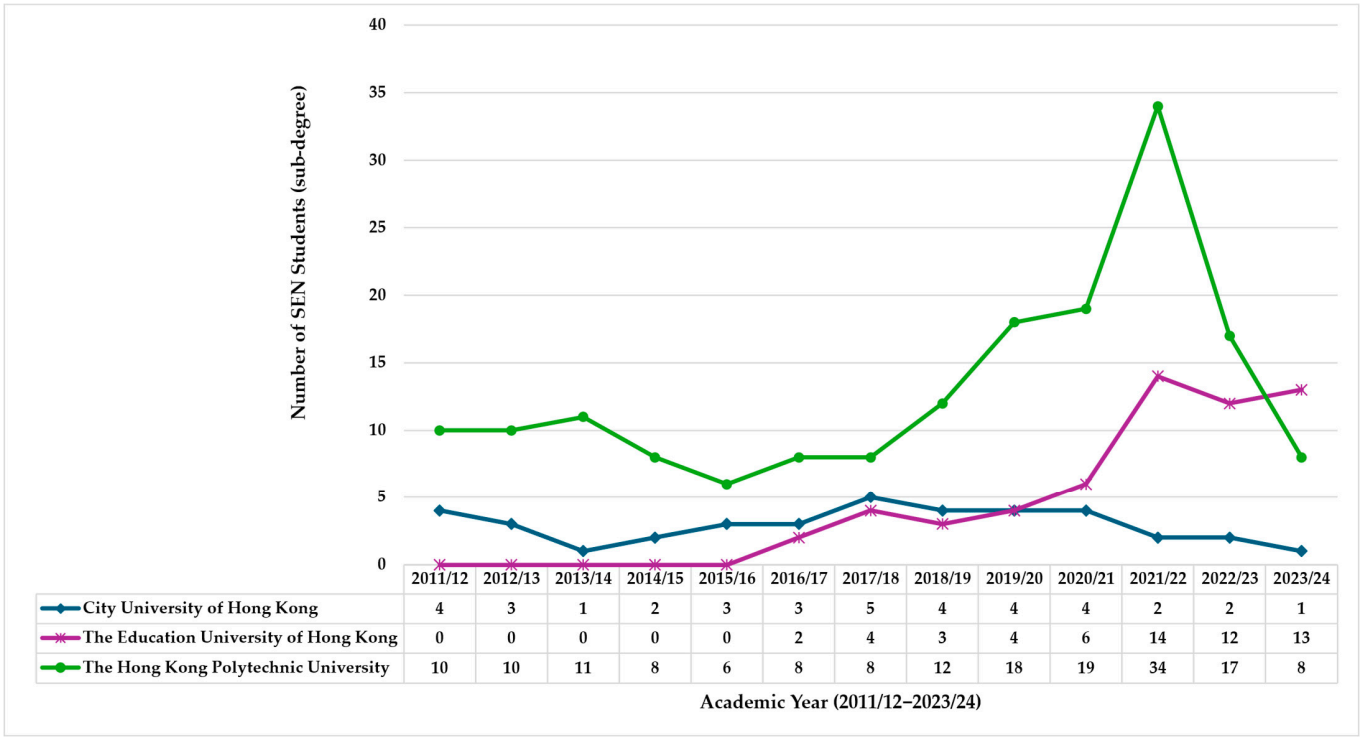
4.1.2. Data Context and Relevance to the Current Study

Based on the data source from https://data.gov.hk/en/analysis of SEN student headcounts in UGC-funded sub-degree and undergraduate programmes at the same university (where we conducted the current study) in Hong Kong over the past decade reveals a robust upward trend (See Figure 1). In 2011/2012, only 2 SEN undergraduates were enrolled, increasing steadily to 103 by 2023/2024. Similarly, sub-degree enrollments, which began in 2016/2017, have gradually risen to 13 in 2023/2024. This sustained growth underscores the institution's commitment to inclusive education and reflects the increasing integration of students with Special Educational Needs in higher education settings.



	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24
City University of Hong Kong	27	26	30	31	41	40	43	57	70	82	108	126	163
Hong Kong Baptist University	20	36	36	40	55	19	30	48	60	59	60	56	82
Lingnan University	2	7	11	16	13	12	14	11	22	35	53	68	100
The Chinese University of Hong Kong	24	35	37	53	42	67	89	94	120	121	132	158	216
The Education University of Hong Kong	2	6	11	17	22	21	27	28	41	42	53	69	103
The Hong Kong Polytechnic University	15	29	34	41	35	47	51	81	101	99	122	163	259
The Hong Kong University of Science and Technology	32	39	34	39	52	59	96	123	134	147	156	209	241
The University of Hong Kong	60	67	59	71	84	107	116	127	143	134	223	283	339

(**a**)



	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24
City University of Hong Kong	4	3	1	2	3	3	5	4	4	4	2	2	1
The Education University of Hong Kong	0	0	0	0	0	2	4	3	4	6	14	12	13
The Hong Kong Polytechnic University	10	10	11	8	6	8	8	12	18	19	34	17	8

(**b**)

Figure 1. (**a**) Distribution of the number of SEN students in UGC-funded universities (undergraduate); (**b**) distribution of the number of SEN students in UGC-funded universities (sub-degree). Note: The charts were created based on the Hong Kong Government's open data, retrieved from https://data.gov.hk/en-data/dataset/hk-ugc-ugc-student-sen-statistics on 23 May 2025.

4.2. Methodology

4.2.1. Participants and Data Collection Procedure

The current study, conducted at the same university mentioned in the data context section above, focuses on participants in a post-secondary training programme for secondary school graduates with SEN and includes a sample of 34 students. Rather than viewing this sample as small, it should be considered representative of the targeted SEN population within specialized training programmes. The sample size aligns with the institution's actual enrollment patterns of SEN students, underscoring the relevance of our investigation in the context of ongoing institutional trends (see Figure 1). Given this trajectory and the strategic commitment of EdUHK to inclusive education, a sample size of over 30 SEN students in the 2024 study is both representative and proportionate. It captures a meaningful cross-section of this growing student population and allows for reliable analysis while aligning with the university's role as a key contributor to the inclusive education agenda in Hong Kong. Participation was voluntary, and informed consent was obtained from all participants prior to data collection. The survey assessed students' perceptions of career maturity and satisfaction with life.

The sample consisted predominantly of male participants (62%), with ages ranging from 19 to 27 years (M = 22.82, SD = 2.61). As shown in Table 1, approximately 80% of participants reported a primary diagnosis of Autism Spectrum Disorder (ASD), Intellectual Disability (ID), or a combination of both. Ethical approval for the study was obtained from the affiliated institutional ethics review board prior to data collection.

Table 1. Special Educational Needs (SEN) categories of participants.

SEN Categories	Count	Percentage
Autism Spectrum Disorder and Intellectual Disability (ASD and ID)	13	38.2%
Autism Spectrum Disorder (ASD)	5	14.7%
Intellectual Disability (ID)	4	11.8%
Intellectual Disability and Other SEN	4	11.8%
Autism Spectrum Disorder and Other SEN	1	2.9%
Other SEN *	7	20.6%

Note: * Other SEN categories include Speech and Language Impairment (SLI; n = 3), Physical Disability (PD; n = 2), Physical Disability with Visual Impairment (PD and VI; n = 1), and Specific Learning Difficulties (SpLD; n = 1).

4.2.2. Measurements

1. Career Maturity Inventory

In this study, the Career Maturity Inventory-Form C (CMI-C) [9] was adapted to address the specific development and cognitive characteristics of students with Special Educational Needs (SEN). The original CMI-C is a theoretically grounded and psychometrically validated instrument designed to assess career choice readiness in secondary school students. It operationalizes career maturity across four subdomains: concern, curiosity, confidence, and consultation.

To ensure content and construct appropriateness for students with SEN, the research team engaged in a collaborative review process with frontline educators (n = 2) and professionals (n = 3) experienced in supporting this population. Through this iterative review, 16 items were selected from the original 24-item pool and underwent minor linguistic and content adaptations to enhance clarity and relevance for SEN learners. The final adapted version included 11 negatively worded items drawn from the concern, curiosity, and confidence subscales, and 5 positively worded items from the consultation subscale (see Table 2). These modifications were guided by both theoretical alignment with the original CMI framework and practical considerations of cognitive accessibility. The primary objective of

the adaptation process was to retain fidelity to the original constructs while optimizing the instrument's interpretability and response burden for SEN students.

Table 2. Items and exploratory factor analysis results.

Items	Item Description	Factor Loading (16 Items)		Factor Loading (14 Items)	
		1	2	1	2
CM_CCR1	I know very little about the requirements of jobs.	0.217	0.511	-	-
CM_CCR2	I am having difficulty in preparing myself for the work that I want to do.	0.494		0.500	
CM_CCR3	I don't know what courses I should take in school.	0.844		0.823	
CM_CCR4	I don't know whether my occupational plans are realistic.	0.744		0.752	
CM_CCR5	Everyone seems to tell me something different; as a result, I don't know what kind of work to choose.	0.651		0.666	
CM_CCR6	I keep changing my occupational choice.	0.772		0.776	
CM_CCR7	There are so many things to consider in choosing an occupation, it is hard to make a decision.	0.784		0.775	
CM_CCR8	I can't seem to become very concerned about my future occupation.	0.433		0.428	
CM_CCR9	I seldom think about the job that I want to enter.	0.872		0.861	
CM_CCR10	I'm not going to worry about choosing an occupation until I am out of school.	0.869		0.872	
CM_CCR11	I really can't find any work that has much appeal to me.	0.872		0.868	
CM_ICC1	I am very clear about what kind of job I will choose.		0.724		0.743
CM_ICC2	Choosing a job is something that you do on your own.	0.607	0.202	-	-
CM_ICC3	It is important to consult close friends and get their ideas before making an occupational choice.		0.680		0.725
CM_ICC4	When it comes to choosing a career, I will ask other people to help me.		0.722		0.679
CM_ICC5	In making career choices, one should pay attention to the thoughts and feelings of family members.		0.781		0.768
Variance explained		38.4%	17.2%	40.4%	17.3%

The revised CMI-C thus serves as a tailored instrument for assessing the career choice readiness profile of SEN students and provides a foundation for developing targeted interventions aimed at supporting their vocational exploration and decision-making processes. For full item content and domain mapping, see Table 2.

2. Satisfaction with Life Scale

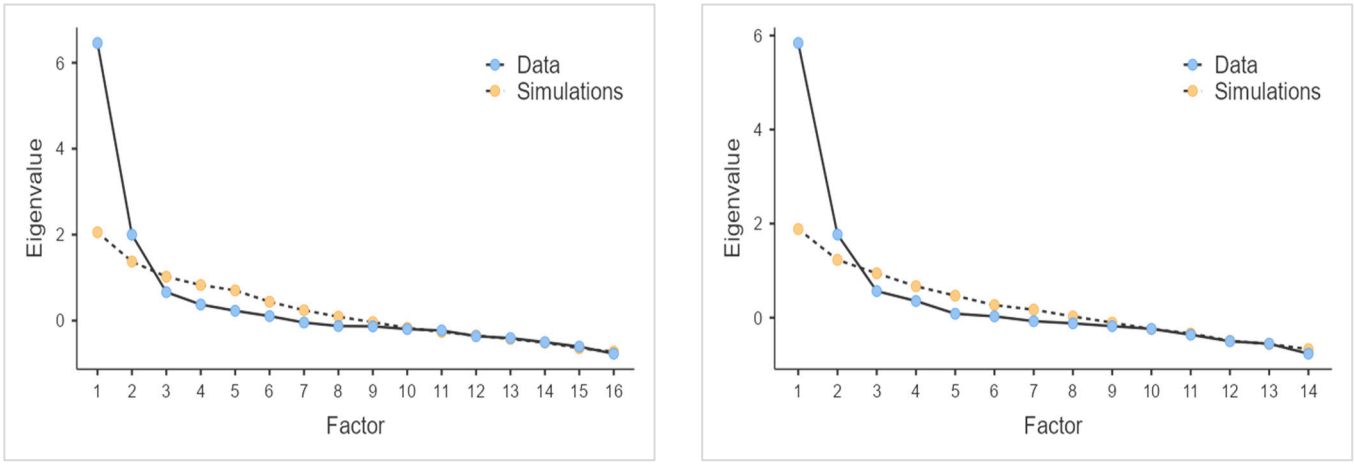
The Satisfaction with Life Scale (SWLS) [39] is a widely used measure of subjective well-being and life satisfaction. The original instrument consists of five items rated on a 7-point Likert scale, ranging from strong disagreement to strong agreement. To accommodate the cognitive processing characteristics of students with SEN, four of the original five items were retained and adapted linguistically to enhance comprehension. Additionally, the response scale was simplified from a 7-point to a 4-point Likert scale to reduce cognitive load and support more reliable self-reporting among participants. These adaptations were implemented to preserve the essence of the SWLS while increasing its accessibility for the

target population. The adapted scale was used as an external criterion to examine the convergent validity of the modified CMI-C.

5. Main Data Analyses and Results

5.1. Exploratory Factor Analysis (EFA)

An EFA was conducted to examine the internal structure of the CMI-C using Principal Axis Factoring with Direct Oblimin rotation, selected because of the anticipated correlations among latent constructs. The analysis was implemented using JAMOVI software (version 2.5) [40]. The Kaiser–Meyer–Olkin (KMO) measure verified sampling adequacy with a value of 0.73, which exceeds the recommended threshold of 0.50 [41]. In addition, Bartlett's test of sphericity was statistically significant, $\chi^2(91) = 305$, $p < 0.001$, confirming that inter-item correlations were sufficiently robust for factor analysis. A parallel analysis and a scree plot (see Figure 2) further supported the decision to extract factors.



(**a**) (**b**)

Figure 2. (**a**) Scree plot of 16 items of Career Maturity Inventory; (**b**) scree plot of 14 items of Career Maturity Inventory.

Items with factor loadings of 0.40 or greater on at least one factor were retained [42]. As presented in Table 2, the EFA revealed a two-factor solution for the 16 items of the CMI-C. Eleven items loaded onto Factor 1 and five items loaded onto Factor 2. Notably, items CM_CCR1 and CM_ICC2 had low loadings and exhibited cross-loadings—CM_CCR1 on Factor 2 and CM_ICC2 on Factor 1—which suggests potential issues with these items in capturing the intended constructs, particularly in a SEN population.

To further examine the impact of these problematic items, an additional EFA was performed excluding items CM_CCR1 and CM_ICC2. This modified analysis yielded a stable two-factor solution: Factor 1 comprised ten items reflecting the career choice readiness aspects of career maturity (CM-CCR), and Factor 2 consisted of four items representing the intention to seek career consultation aspects of career maturity (CM-ICC) (see Figure 2 and Table 2). The decision to exclude these items was guided by both theoretical considerations and the empirical data, as their inclusion might distort the intended measurement structure.

5.2. Rasch Analysis

To further investigate the psychometric properties of the refined 14-item instrument, a Rasch analysis was conducted to examine its dimensionality, item functioning, and reliability. Rasch analysis is a robust method for instrument validation, providing diagnostic metrics such as item difficulty, infit mean square (MNSQ), and outfit MNSQ

statistics, which are critical for identifying problematic items and refining the measurement model [43,44]. According to Linacre [45], acceptable infit and outfit MNSQ values range between 0.5 and 1.5.

To evaluate the dimensionality of the instrument, three Rasch models were evaluated: a uni-dimensional model, two-dimensional model (CCR: career choice readiness; ICC: intention to seek career consultation), and four-dimensional structures. (The original four dimensions proposed by Savickas and Porfeli [9] for high school students include curiosity, confidence, concern, and consultation.) Fit indices including the Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), and Consistent Akaike Information Criterion (CAIC) were examined. The two-dimensional model yielded substantially lower fit indices compared to the uni-dimensional model and the four-dimensional model, indicating superior model fit. These results (see Table 3 for details) suggest that the underlying construct is better represented by two distinct but related latent dimensions rather than a single factor or the four-factor model.

Table 3. Model comparison results.

Model	Description	AIC	BIC	CAIC
1	Uni-dimensional	938.55	964.50	981.50
2	Two-dimensional model	875.10	904.10	923.10
3	Four-dimensional model	880.81	920.50	946.50

Table 4 provides a detailed examination of item-level performance, including item difficulty, and infit and outfit MNSQ values (see also Figure 3). All item fit indices for the two-dimensional model were within the acceptable range (0.5–1.5, [46]). Furthermore, the Expected A Posteriori (EAP) reliability (meaning the ratio of the true variance in person ability estimates to the observed variance) estimates further supported the enhanced precision of the two-dimensional model, with estimates of 0.92 for CM-CCR and 0.78 for CM-ICC. A high EAP reliability indicates the scale can differentiate well between individuals in the latent trait. This detailed comparative analysis underscores the two-dimensional structure as both statistically robust and theoretically justifiable, while also highlighting specific areas (e.g., lower reliability of positive items) that may warrant further refinement in future research.

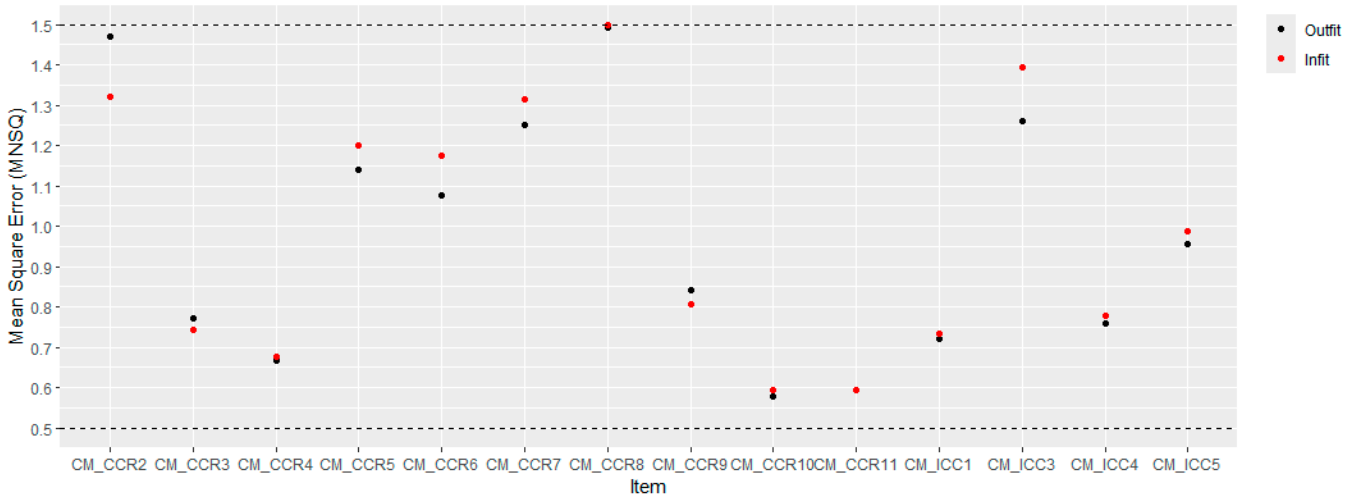


Figure 3. Mean square error (MNSQ) fit plot for the 14-item CMI-C. Note: the two dashed lines represent the cutoff values of MNSQ (0.5–1.5).

Table 4. Rasch analysis results of 14 items CMI-C.

Items	Two-Dimensional Model				
	Difficulty	SE	MNSQ		EAP
			Infit	Outfit	
CM_CCR2	−0.794	0.321	1.313	1.458	0.92
CM_CCR3	−0.386	0.317	0.739	0.770	
CM_CCR4	−0.386	0.317	0.676	0.669	
CM_CCR5	−1.431	0.331	1.195	1.133	
CM_CCR6	−1.541	0.333	1.170	1.070	
CM_CCR7	−1.215	0.327	1.297	1.239	
CM_CCR8	−0.898	0.323	1.500	1.493	
CM_CCR9	−0.286	0.316	0.799	0.832	
CM_CCR10	−1.292	0.334	0.607	0.597	
CM_CCR11	−0.691	0.320	0.603	0.606	
CM_ICC1	−2.398	0.344	0.728	0.729	0.78
CM_ICC3	−2.151	0.345	1.410	1.280	
CM_ICC4	−3.140	0.360	0.774	0.751	
CM_ICC5	−2.398	0.344	0.999	0.966	
Min	−3.140	0.316	0.603	0.597	
Max	−0.286	0.360	1.500	1.493	

Note: Item CM_CCR1 and item CM_ICC2 were removed from this round of Rasch analysis due to the poor explanation to the relative dimension based on the results of EFA. CM = career maturity, CCR = career choice readiness, ICC = intention to seek career consultation.

5.3. Correlation Analysis

Table 5 presents the intercorrelations, descriptive statistics (means and standard deviations), and internal consistency estimates for two versions of the career-related constructs: career choice readiness (CCR) and intention to seek career consultation (ICC). The first version consists of an 11-item CCR scale (CCR11) and a 5-item ICC scale (ICC5), while the revised version comprises a 10-item CCR scale (CCR10) and a 4-item ICC scale (ICC4), following the removal of two problematic items.

Table 5. Correlation, mean and standard deviation (SD) of CCR and ICC dimensions of CMI-Form C.

	CMI_ Version 1 (16 Items)		CMI_ Version 2 (14 Items)		
	1	2	3	4	5
1. CMI_CCR (11 items)	—				
2. CMI_ICC (5 items)	0.404 *	—			
3. CMI_CCR (10 items)	0.996 ***	0.371 *	—		
4. CMI_ICC (4 items)	0.271	0.969 ***	0.232	—	
5. Satisfaction with life (SWL)	0.266	0.495 **	0.223	0.449 **	—
Mean	2.82	3.19	2.80	3.21	3.39
SD	0.59	0.50	0.62	0.55	0.45
Cronbach's α	0.92	0.77	0.93	0.80	0.84
McDonald's ω	0.92	0.79	0.93	0.81	0.85

Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Both versions demonstrated high internal consistency, with Cronbach's α values of 0.92 (CCR11), 0.93 (CCR10), 0.77 (ICC5), 0.80 (ICC4), and 0.84 for satisfaction with life (SWL). McDonald's ω coefficients were comparable, supporting the reliability of these measures. Lower scores on the CCR scales indicate greater career choice readiness, as the items are negatively worded (e.g., "*I know very little about the requirements of jobs*"), while higher scores on the ICC scales indicate greater intention to seek career consultation, as the items are positively worded (e.g., "*It is important to consult close friends and get their ideas before making an occupational choice*").

The correlation between CCR11 and CCR10 was nearly perfect (r = 0.996, $p < 0.001$), as was the correlation between ICC5 and ICC4 (r = 0.969, $p < 0.001$), indicating that the

removal of items had minimal impact on the constructs measured. Moderate, positive, and significant correlations were found between SWL and both ICC measures (r = 0.495 for ICC5; r = 0.449 for ICC4, both $p < 0.01$), whereas correlations between SWL and CCR were positive but smaller in magnitude (r = 0.266 for CCR11; r = 0.223 for CCR10). The correlation between CCR and ICC was non-significant for the short forms. This modest association, and its reduction following item refinement, may reflect that students with SEN perceive career choice readiness and intention to seek career consultation as related but distinct constructs, which is consistent with the multidimensionality of the CMI-Form C [9]. Importantly, the results highlight that, for SEN students, satisfaction with life is more closely linked to their intention to access career consultation than to their self-reported readiness for making career choices. This pattern underscores the value of designing transition and support programmes that prioritize accessible, targeted career guidance—addressing both the motivational and practical needs of SEN students to facilitate effective career planning and decision-making [47–49].

5.4. Supplementary Data Analysis

A quadrant analysis was conducted to complement aggregate-level findings by identifying meaningful subgroups based on students' career choice readiness and consultation intention. This person-centered approach helps reveal intra-group variability often masked by traditional statistical techniques [50]. Such visualization supports differentiated career interventions. For example, students with low readiness but high consultation intention may benefit from structured career planning, while those low on both dimensions may require foundational motivational support [51]. Given the heterogeneity of students with Special Educational Needs (SEN), particularly in help-seeking and self-regulation behaviors [52], quadrant analysis offers a practical tool to inform inclusive, needs-based career support strategies.

The scatterplot (Figure 4) distributes 34 participants along two dimensions—career choice readiness (horizontal axis) and intention to consult others (vertical axis)—dividing the sample into four quadrants that reflect distinct career-development profiles.

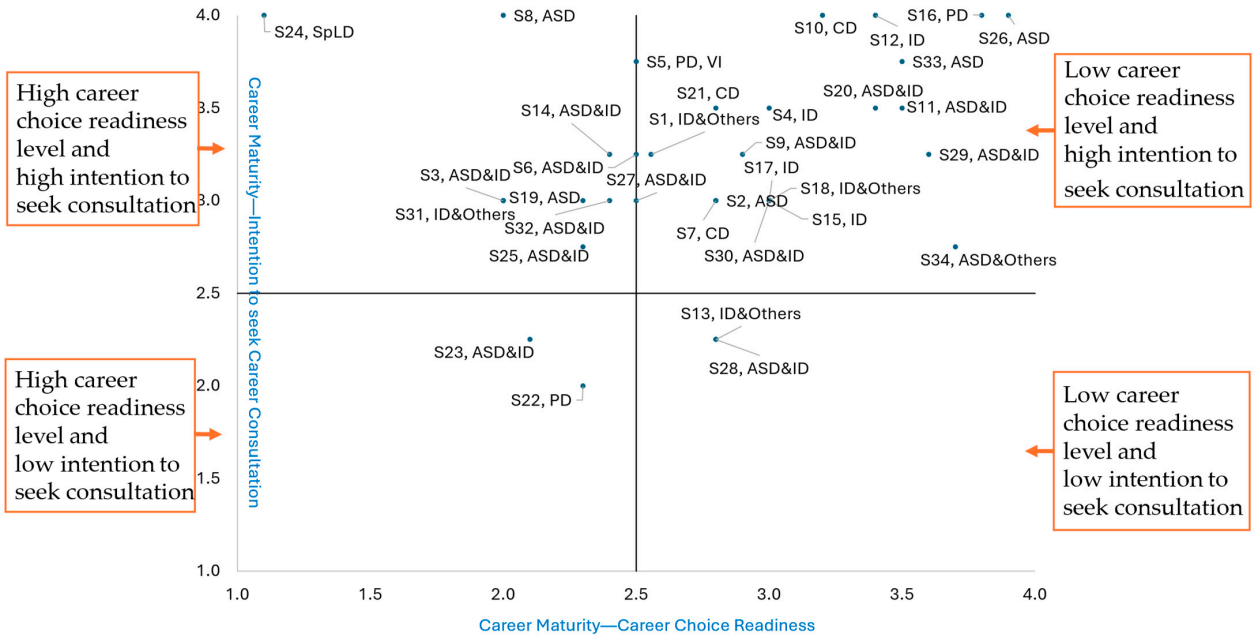


Figure 4. Distribution of participants' career choice readiness and consultation intention level. Note: For career maturity–career choice readiness, a higher score means low readiness status. For career maturity–intention to seek career consultation, a higher score means greater intention to seek career consultation.

1. Top-right quadrant: Low career choice readiness–high intention to seek career consultation.

Approximately 53% of the 34 students cluster here. They lean heavily on others for advice but report comparatively lower self-perceived readiness to make career decisions independently. Because strong external support alone may not suffice for autonomous career development, these students may benefit from targeted skill-building and structured experiences (e.g., role-playing interviews, internship simulations) designed to bolster their decision-making confidence. Enhancing their sense of competence could potentially improve career maturity.

2. Top-left quadrant: High career choice readiness–high intention to seek career consultation.

Around 26% of the participants appear in this quadrant, suggesting they are well-prepared to make career choices yet continue to value and seek out interpersonal input. Such students often benefit from collaborative decision-making environments that validate their readiness and refine their career goals through constructive dialogue with peers, teachers, or mentors.

3. Bottom-right quadrant: Low career choice readiness–low intention to seek career consultation.

About 6% of individuals fall here, indicating a relative lack of both career decision-making skills and inclination to seek guidance. They may overlook valuable input from others, further impeding their developmental trajectory. In practice, dual-faceted interventions could address both attitudinal and behavioral barriers, building awareness of potential career paths and systematically encouraging greater openness to mentorship.

4. Bottom-left quadrant: High career choice readiness–low intention to seek career consultation.

Roughly 6% of students occupy this zone, demonstrating confident readiness but relatively less inclination to involve others in their career planning. While independence is a valued skill, these individuals may miss opportunities to enrich their decision-making through broader perspectives. Encouraging selective collaboration—such as targeted discussions with professionals or peers could help refine their career paths.

Supplementary analyses further illustrate the distinct profiles of career choice readiness (CCR) and intention to seek career consultation (ICC) across special educational needs groups (see Figure S1 in the Supplementary Materials). Differential item functioning (DIF) analysis by gender is also reported in Appendix A (Table A1). While most items demonstrated negligible DIF (within ±0.5 logits), Item CM_ICC3 (*"It is important to consult close friends and get their ideas before making an occupational choice."*) showed substantial DIF (contrast = 0.658), suggesting potential gender-based differences in interpretation. This finding highlights the need for further qualitative inquiry and replication with a larger, more balanced sample to evaluate the item's stability and fairness.

6. Discussion

This study examined the psychometric properties of an adapted 16-item Career Maturity Inventory (CMI-C) specifically designed for Chinese students with Special Educational Needs (SEN). Although the original instrument was theoretically structured around four dimensions—concern, confidence, curiosity, and consultation [9]—our empirical findings indicate that a two-factor model better represents the data within this particular group of students with SEN. This divergence from the conventional four-dimensional model is consistent with previous research suggesting that conventional career maturity constructs, first advanced by Super [15] and later refined by Crites [10–12], may not fully capture the nuanced developmental profiles of diverse learner groups such as SEN students [2]. In

our study, the merging of concern, confidence, and curiosity into a broader "career choice readiness" construct may partly reflect the unique cognitive and interpretative processes of SEN students, as well as potential measurement limitations. However, we also recognize that this empirical consolidation might be influenced by sample characteristics rather than solely by underlying theoretical differences.

Initial exploratory factor analysis revealed that two items' factor loadings (CM_CCR1 and CM_ICC2) did not correctly load onto their respective factors. These anomalies are reminiscent of earlier challenges identified in adapting instruments originally developed for typically developing populations, indicating that certain items may require modification to ensure clarity and relevance among SEN students [29]. Upon excluding these problematic items, the subsequent EFA revealed a consistent two-factor structure emerging from the remaining 14 items. The recalibrated factors demonstrated strong correlations with the original factors as well as external criteria, underscoring the refined instrument's potential for accurately assessing career maturity among SEN students. Nonetheless, given that the original literature (e.g., Savickas & Porfeli [9]; Crites & Savickas [13]) emphasizes multidimensionality in career adaptability, caution is warranted in overextending these preliminary empirical findings beyond their immediate context.

The pattern of correlations between the two dimensions of CMI-C highlights the complexity of the constructs under study. This outcome is consistent with career development theory and empirical research, which indicate that adolescents with higher career maturity may display both adaptive help-seeking and independent decision-making behaviors [14,53,54]. Some students who feel well-prepared may proactively consult others to broaden their perspectives, while others may rely on self-efficacy and make decisions more independently, resulting in a weak or non-significant association [3]. It also aligns with cultural patterns in Hong Kong and other Asian contexts, where consultation and help-seeking are encouraged by collective values. This cultural orientation allows readiness and consultation to reinforce one another, rather than operate as opposing tendencies [2,7]. The moderate, significant correlation between intention to seek career consultation and satisfaction with life aligns with contemporary research linking career support to well-being, particularly for marginalized students [55,56]. The non-significant associations of career choice readiness with consultation intention and SWL may reflect SEN students' specific barriers, such as lower self-advocacy or systemic gaps in transition planning [57]. These results emphasize integrating targeted career guidance with psychosocial interventions (e.g., promoting and enhancing self-determination) to enhance post-school outcomes, as proactive consultation may mitigate transition-related stress [58]. In summary, our findings reflect the complexity of career planning, where readiness and consultation may coexist or operate independently, a pattern supported by research demonstrating both the multidimensional nature of adolescent career decision-making and the influence of individual and cultural factors on help-seeking [2,3,7,14,53,54].

The quadrant analysis further highlights the diversity of career development profiles among SEN students, offering practical insight for differentiated support. Over half of the students (53%) showed low career choice readiness but high consultation intention, indicating a strong help-seeking yet limited decision-making confidence, pointing out an area suited for structured, skill-based interventions. For this group of students with SEN, we recommend a structured, multi-session intervention combining career decision-making skills workshops with facilitated peer and mentor support. Building on recent evidence, an effective intervention for students with low career choice readiness but high consultation intention could combine structured skill-building workshops, peer/mentor support, and targeted mentoring. Lau, Chung, and Wang [16] demonstrated that career exploration workshops significantly enhance career maturity and self-concept, suggesting

that interactive activities focused on self-assessment, goal setting, and career planning can foster foundational readiness. Complementing this, Parola, Marcionetti, and Wong [4] found that teacher and peer support both play crucial roles in boosting career decision self-efficacy, particularly when delivered through group-based or collaborative settings. For students with SEN, a strengths-based mentoring approach, as evaluated by Yuen et al. [37], has shown promise in enhancing self-efficacy and long-term career planning outcomes. Thus, a combined intervention might begin with a series of skill-building workshops, followed by regular small-group or peer-mentoring sessions facilitated by trained mentors or teachers. This structure leverages both self-directed growth and the positive influence of supportive relationships, equipping SEN students to navigate career decisions more confidently and independently.

A smaller group (26%) combined high readiness with high consultation, benefiting from mentoring to refine well-formed goals. Two smaller subgroups (each ~6%) presented greater challenges: one with low readiness and low consultation, suggesting the need for foundational support to build awareness and normalize guidance-seeking [52]; the other with high readiness but low consultation, where selective collaboration may enhance decision quality without reducing autonomy [59]. These patterns reinforce the importance of tailoring interventions not only to career capability but also to consultation orientation [37,50].

While this study provides initial evidence supporting the two-dimensional structure of the adapted instrument using Rasch analysis, it is important to acknowledge limitations related to sample size. The stability and generalizability of both factor and Rasch model estimates can be influenced by smaller samples, as parameter estimates and fit statistics may be subject to greater sampling variability. Nevertheless, it should be noted that this sample comprising 34 school leavers with Special Educational Needs (SEN) enrolled in a professional training programme in higher education is relatively representative of the accessible SEN cohort within such specialized programmes in Hong Kong. According to official enrollment data, the number of SEN students in UGC-funded sub-degree and undergraduate programmes at our institution has increased substantially in the past decade, and our sample size aligns with current enrollment patterns, reflecting a meaningful cross-section of this targeted population.

SEN students, particularly those transitioning to post-secondary and professional pathways, are an inherently hard-to-reach group due to their lower prevalence, diverse needs, and additional barriers to research participation. As such, sample sizes in studies with this population are frequently constrained and may not be directly comparable to studies involving SEN students in mainstream educational settings (see also Figure 1a,b). Despite these challenges, the current sample provides valuable and contextually relevant evidence for instrument validity in the context of specialized higher education programmes.

Nonetheless, the results should be interpreted with appropriate caution, and future research is encouraged to replicate these analyses with larger and more diverse SEN samples across both specialized and mainstream settings to further examine the stability and applicability of the measurement model. Such efforts will support the ongoing development of robust and inclusive assessment tools that address the diverse needs of SEN students in higher education.

7. Implications

This study provides important theoretical and practical contributions to the literature on career maturity, sustainable education, and support for students with Special Educational Needs (SEN). The shift from a traditional four-dimensional to a two-dimensional model—consolidating concern, confidence, and curiosity into a unified "career choice

readiness" construct—suggests that established constructs within career maturity theory [8,10–15] may not operate uniformly across populations. This pattern aligns with recent calls by Wong [28] and others for locally validated, context-sensitive measures, particularly for diverse or marginalized groups. Our findings echo international research demonstrating that the conceptualization and measurement of career-related constructs often require adaptation to meet the developmental realities of SEN students [4,37,38].

From a sustainable education perspective, these results have direct implications for advancing Sustainable Development Goal 4 (SDG 4), which seeks to "ensure inclusive and equitable quality education and promote lifelong learning opportunities for all" [36]. By providing a validated tool tailored for SEN learners, this study supports the operationalization of SDG 4 in real-world educational settings. The revised CMI-C allows educators and policymakers to identify students' career readiness and consultation profiles, enabling evidence-based and differentiated interventions that address individual needs [3,4,6,9]. This tailored approach is particularly relevant in inclusive education systems, where heterogeneity in student needs demands flexible, responsive, and data-driven support strategies.

Practically, our quadrant analysis and visual profiling (scatterplots, polar area charts) offer practitioners a robust method for identifying distinct student subgroups—such as those with low readiness but high consultation intention—and designing targeted interventions accordingly. For example, students demonstrating low career readiness may benefit from skill-building workshops that promote autonomous decision-making [16,18,29,30], while those with specific consultation styles can be guided through structured peer or mentor engagement [3,4,20,23,24,60]. These recommendations are supported by recent SSCI-indexed research highlighting the efficacy of differentiated counseling, mentoring, and strengths-based programmes for improving career outcomes and well-being in SEN and general student populations [4,37,38].

Recent research demonstrates that career choice readiness tends to increase as students progress through phases of the career decision-making process, with those in later phases generally exhibiting higher readiness [61]. This progression is not strictly linear, as students may consider more career alternatives mid-process and fewer at the beginning and end, suggesting that readiness and decisional clarity can evolve together during adolescence. Complementing this, longitudinal studies have found that career choice readiness develops over time, with students following a range of trajectories such as high–increasing, moderate–increasing, and consistently low [54]. Higher levels and growth in readiness are associated with factors like self-esteem, self-efficacy, fewer perceived barriers, and increased access to career information. Environmental support and guidance are associated with readiness growth, while individual differences may influence readiness level more than its change over time.

Distinguishing between the dimensions of career choice readiness and consultation style may assist school counsellors in planning targeted support for students with differing needs. For example, after administering the instrument, students with lower career choice readiness could be invited to participate in workshops focused on self-awareness and decision-making strategies. Similarly, students showing certain consultation styles might participate in peer mentoring or group discussions facilitated by teachers to foster communication and feedback skills. These differentiated approaches are in line with inclusive educational practices, where tailoring interventions to students' profiles is considered beneficial. Such strategies are consistent with research highlighting the relevance of environmental factors—such as information and support provision—in readiness development [54], and with the importance of recognizing students' varying phases in the decision-making process [61].

In addition, visual summaries (e.g., quadrant scatterplots) may assist practitioners in identifying students who might benefit from additional support, supporting informed decision-making in school-based career guidance. While these examples suggest possible applications, further research and implementation are needed to establish the most effective ways to use this instrument in diverse educational contexts. This approach is also in line with findings that both teacher- and peer-supported interventions can help address some career development challenges among SEN students [3,4,6].

Methodologically, this study demonstrates the value of combining exploratory factor analysis and Rasch modeling for scale validation in small, hard-to-reach samples [41–45]. The findings further support the ongoing refinement of assessment tools, advocating for the integration of mixed methods—such as interviews or observations—to supplement quantitative analysis and enhance validity.

8. Limitations and Directions for Future Research

Despite the promising results, several limitations must be acknowledged. First, the relatively small and homogeneous sample size may restrict the generalizability of our findings. Future research should replicate these results in larger, more diverse samples, as previously advocated by scholars examining career maturity in varied cultural contexts [16,17]. Additionally, the reliance on self-report measures introduces the possibility of response bias, underscoring the need for multi-method approaches, including structured interviews and observational techniques, in order to capture a more comprehensive picture of career maturity among SEN populations.

Moreover, the cross-sectional nature of the study limits our ability to capture the dynamic evolution of career choice readiness and consultation styles over time. To better understand how career maturity develops and changes in SEN students, we recommend future longitudinal studies that track the same individuals across multiple time points. (For a recent meta-analysis, see [62]). Such studies would enable researchers to assess the stability, progression, and influencing factors of career maturity throughout key educational transitions (e.g., [37]). Longitudinal designs, as suggested by Ham and Lim [19], would allow for the testing of concrete hypotheses regarding the stability and progression of these constructs. The negative loadings observed for certain items further suggest that methodological constraints may influence measurement, thereby underscoring the need for subsequent studies to explore the moderating effects of contextual and cultural factors. In light of the changing structure of the world of work [28] and the evolving nature of career development, future research should examine whether the observed factor structure is specific to the Chinese context or if it generalizes across diverse educational systems.

9. Conclusions

The findings of this study provide robust support for the adapted CMI-C as a psychometrically sound instrument for assessing career maturity among SEN school leavers in post-secondary training. The construct validity and reliability of the scale were established through a stable two-factor structure, comprising negative career choice readiness and positive intention to seek career consultation, with all retained items demonstrating satisfactory loadings and strong internal consistency. Model comparisons confirmed that the two-dimensional solution offered the best fit for this population, aligning with both statistical criteria and theoretical expectations. Furthermore, criterion-related validity was supported by the observed positive association between both career choice readiness and intention to seek career consultation and satisfaction with life. While the sample size of 34 students may appear small/modest, it is relatively representative of the hard-to-reach SEN school leaver population in specialized post-secondary training, reflecting actual

institutional enrollment patterns and the ongoing upward trend of SEN participation in higher education in Hong Kong (see Figure 1). Nevertheless, future research should seek to replicate and extend these findings in larger and more diverse SEN cohorts across multiple institutions to further confirm the scale's generalizability and utility.

Supplementary Materials: The following supporting information can be downloaded at https://www.mdpi.com/article/10.3390/su17146641/s1. Figure S1: Radar plot profiles of career choice readiness (CCR), and intention to seek career consultation (ICC) by Special Educational Needs group. References [9,63–66] are cited in the Supplementary Materials.

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Institutional Review Board Statement: This study involved human participants and was conducted in full compliance with institutional ethical guidelines for research involving human subjects. Ethical approval was granted by the Human Research Ethics Committee (HREC) of The Education University of Hong Kong under two reference numbers: 2020-2021-0138 for the General Research Fund (GRF) project on Special Educational Needs [Project Code: 18612721], in which Fengzhan Gao served as a part-time Senior Research Assistant, approved 14 December 2020; and 2024-2025-0105 for the project titled Career Development Assessment of Adolescents with Special Educational Needs: A Comprehensive Exploration of Career-Related Self-Concept, led by Fengzhan Gao and supervised by Kuen-Fung Sin and Lan Yang, approved 11 March 2025. These approvals confirm that all procedures involving human participants adhered to institutional ethical standards.

Informed Consent Statement: All human participants provided informed consent prior to their inclusion in the study. Where applicable, participants were also informed about the intended publication of the findings and provided consent for the same.

Data Availability Statement: The data presented in this study are available, upon reasonable request, from the corresponding author. The data are not publicly available due to participant confidentiality and institutional data use agreements.

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Abbreviations

The following abbreviations are used in this manuscript:

CMI-C	Career Maturity Inventory-Form C
CM_CCR	Career Maturity–Career Choice Readiness

CM_ICC	Career Maturity–Intention to Seek Career Consultation
SEN	Special Educational Needs
ASD	Autism Spectrum Disorder
ID	Intellectual Disability
PD	Physical Disability
SLI	Speech and Language Impairment
VI	Visual Impairment
SpLD	Specific Learning Disabilities
MNSQ	Mean Square
CCR	Career Choice Readiness
ICC	Intention to Seek Career Consultation

Appendix A

Table A1 presents the differential item functioning (DIF) contrast for each item by gender. A positive DIF contrast indicates the item was more difficult for females than males, and vice versa. Values exceeding ±0.5 logits were flagged for potential differential item functioning. In general, the scale demonstrates strong measurement invariance across gender, supporting its fairness and comparability for male and female students with Special Educational Needs. All other items fall within the commonly accepted threshold of ±0.5 logits for negligible DIF [67]. Only Item CM_ICC3 ("It is important to consult close friends and GT their ideas before making an occupational choice.") shows substantial DIF, with an absolute contrast of 0.658, suggesting potential gender-based differences in item interpretation or relevance, warranting further qualitative investigation, possible item refinement, or the application of gender-specific norms in future use. Future studies should investigate whether the item content, wording, or context might be interpreted differently by gender groups. Follow-up DIF analysis with a larger and more balanced sample is encouraged to confirm the stability of this finding, particularly given the small sample size (n = 34) in the current study.

Table A1. Differential item functioning (DIF) analysis by gender.

Item	DIF Pair	DIF Measure	S.E.	z-Value	DIF Contrast
CM_CCR2	Male vs. Female	−0.035	0.124	−0.282	−0.070
CM_CCR3	Male vs. Female	−0.088	0.123	−0.715	−0.176
CM_CCR4	Male vs. Female	0.115	0.124	0.927	0.230
CM_CCR5	Male vs. Female	0.059	0.126	0.468	0.118
CM_CCR6	Male vs. Female	−0.039	0.126	−0.310	−0.078
CM_CCR7	Male vs. Female	−0.048	0.125	−0.384	−0.096
CM_CCR8	Male vs. Female	−0.191	0.124	−1.540	−0.382
CM_CCR9	Male vs. Female	−0.067	0.123	−0.545	−0.134
CM_CCR10	Male vs. Female	−0.005	0.127	−0.039	−0.010
CM_CCR11	Male vs. Female	−0.015	0.124	−0.121	−0.030
CM_ICC1	Male vs. Female	−0.016	0.128	−0.125	−0.032
CM_ICC3	Male vs. Female	0.329	0.129	2.550	0.658
CM_ICC4	Male vs. Female	−0.072	0.134	−0.537	−0.144
CM_ICC5	Male vs. Female	0.072	0.454	0.159	0.144

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