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INNOVATION, IMPLEMENTATION, IMPROVEMENT

THE CLINICAL TEACHER ASME

Construction and validation of a medical career readiness inventory

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Abstract

Background: Medical students' preparedness for clinical practice is well researched, yet little is known on the extent to which students are being prepared for a medical career. This paper reports the construction of a short medical inventory titled eXploring medical sTudents' caReer reAdiness (XTRA) to measure students' career readiness based on Super's theory of career maturity.

Approach: We designed an instrument consisting of a series of 5-point Likert-scale to identify participants competencies regarding career exploration and planning during their undergraduate studies. The instrument was completed by 348 medical students from 41 universities in the United Kingdom. We examined the validity and reliability of the instrument through Exploratory Factor Analysis, Cronbach's coefficient α and Pearson correlation.

Evaluation: Exploratory Factor Analysis revealed that 16 of the 20-items survey were aligned with the exploration stage of Super's theory: Crystallisation (Career goals), Specification (Career pathways) and Implementation (Career accomplishments). The four items that formed two separate statistical factors were specific to a current medical career in the UK. Internal reliability for Super's factor subscales were acceptable ($\alpha = 0.71$ to $\alpha = 0.81$). A significant positive relationship was found between students' overall rating of career readiness and the three factors, indicating construct validity.

Implications: The XTRA Inventory is a short instrument with construct and content validity specifically designed to measure career readiness of medical students. Further work on its psychometric properties will help establish this inventory to be used as a guidance and career counselling tool by medical educators and educational institutions in developing career development programmes.

1 | BACKGROUND

There are multiple facets to a medical career and medical schools prepare students for many of the key knowledge, skills and qualities needed to be a doctor.[1] Students are encouraged to participate in research, leadership, management, and teaching activities to contribute towards career planning. Having conducted a short market survey into medical students' career development needs, we found that not

all students are aware of such opportunities and medical schools are inconsistent in career planning support.[2] Research to date regarding readiness focusses on how medical schools prepare students for transitioning into clinical practice as juniors[3] and on career choices related to specific specialties.[4] Locally developed surveys have been previously used mainly as the basis for career coaching models,[5] but not specifically designed for medical students. The only exception was the inventory developed by Savickas,[6] who adapted Super's lifespan, life-space theory[7] in 1983 to investigate the effect of career guidance on undergraduate medical students' speciality preferences and measure vocational development. However, this research has been limited to America[6] and Pakistan,[4] mostly undertaken prior to 2007. Further, its basis has been on exploring medicine as a career choice as well as specialty interests. Given the evolving nature of the medical career, a more contemporary measure is needed to include aspects that have not been previously considered in the 21st century medical education context. Super's theory[7] can help academics in addressing this gap by providing useful insights into career maturity and recognising the need for intentional efforts towards career development. In this paper we report the construction and validation of a contemporary instrument of career readiness, based on Super's theory.[7] The inventory could be used to identify potential gaps and develop suitable interventions aimed at helping students develop their medical career.

We report the construction and validation of a contemporary instrument of career readiness, based on Super's theory.

2 | APPROACH

Guided by AMEE Guide n.87[8] to inform instrument formation and validation, the first stage of development required immersion into Super's theory,[7] which provided the basis for the main domains of our inventory. Constructed from the ground up, we adapted the theory to a contemporaneous medical career based on our literature review and medical councils' career progression requirements.[1,9] Super's theory is a well-known theory within the developmental paradigm of career readiness,[7] describing career development as a flexible movement through five stages: (1) growth (development of self-concept); (2) exploration (making career decisions through experience); (3) establishment (creating a stable workplace position); (4) maintenance (continual occupational improvement and security); and (5) decline (retirement).[7] According to Super, medical students are at the 'exploratory' stage of their career. This stage consists of three main phases: (1) Crystallisation; (2) Specification; and (3) Implementation (Figure 1).

The next stage of development consisted of pre-validation with a pilot-study involving 21 medical student volunteers completing a questionnaire and taking part in the cognitive interview. Several modifications were made, such as rewording and inclusion of additional items. A 26-item online questionnaire split into two parts was formed using after two iterations of content validation.[10] Part 1 asks for demographics and part 2 consists of 2 items based on Super's theory[11] designed to tap into Crystallisation (n = 5), Specification (n = 6) and Implementation (n = 9). For the Crystallisation and Specification, participants were required to indicate their agreement with 1 = *strongly disagree* and 5 = *strongly agree*. For the Implementation, they were asked to rate experience ranging from 1 = *no experience* and 5 = *a lot of experience*. An additional single item asked participants to rate on a scale from 1 to 5 their self-perception of career readiness.

A snowball approach was used to recruit undergraduate and graduate-entry students from UK medical schools via social media. Those who volunteered followed a link to a Microsoft Office Forms and could withdraw at any point. A total of 348 responses from 41 of 42 medical schools were analysed. Most participants (92.8%) were aged between 18 and 25 years old, and 65.8% were female. Clinical students comprised 48.9% of participants, while 23.9% were preclinical students and 16.4% final year students, with the remainder in intercalating degrees. Graduate medical students accounted for 6.3% of participants.

Analyses were conducted using the IBM SPSS Statistics version 27. Descriptive statistics were obtained and Exploratory Factor Analysis (EFA) was used to identify sub-scales and test the content validity of the inventory. Internal reliability was evaluated using Cronbach's α coefficient (CCA). A Pearson's correlation was used to establish internal consistency within scale items and construct validity.

3 | ETHICS APPROVAL

Ethical approval was granted by Cardiff University School of Medicine Research Ethics Committee.

4 | EVALUATION

4.1 | Content validity

An EFA using principal components analysis and varimax rotation to extract common factors on the three main questionnaire sections was conducted.[11] The Kaiser-Meyer-Olkin measure of sampling adequacy was significant at 0.81, and so was Bartlett's test of sphericity ($\chi^2[190] = 2131.92$, $p < 0.001$) demonstrating appropriateness for

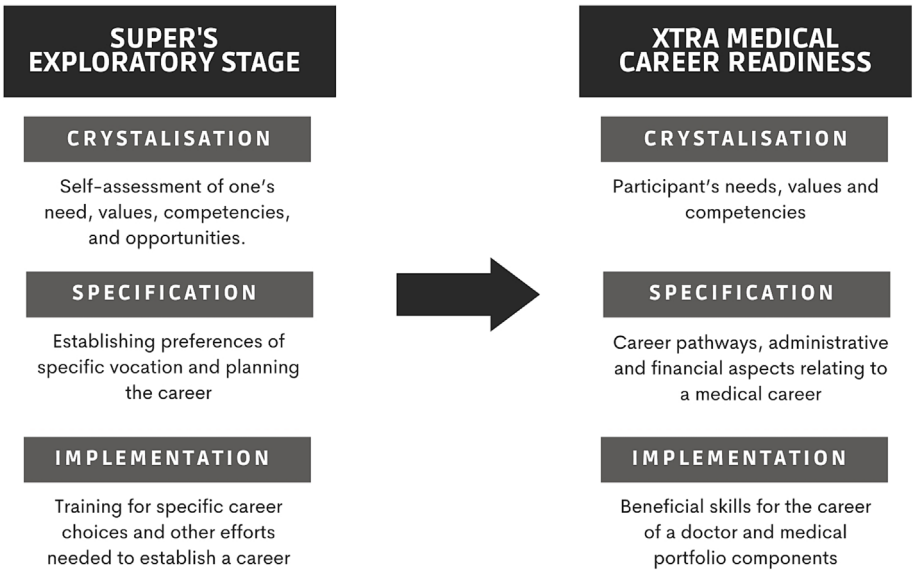

FIGURE 1 Conceptual framework of the inventory based on the Exploratory Stage of career development from Super's lifespan, life-space theory.

EFA.[11] Twenty items were grouped into five factors and a factor loading of >0.60 was selected. Items loading between 0.40–0.50 were evaluated on a case-by-case basis alongside the item's conceptual importance. Items were arranged into five factors according to size of loading, highlighting common themes (Table 1). Factor one, two and three labelled as 'Introspection', 'Insight into Working Life' and 'Portfolio Development' are aligned with Super's *Crystallisation, Specification and Implementation* stage, respectively. Four of the items did not align with Super's theory, and captured items on foundation and specialty training pathways, as well as experiences with additional degrees and entrepreneurship.

4.2 | Internal reliability and construct validity

Each factor was considered as a sub-scale so composite scores were calculated by joining item scores within each domain before proceeding to examine reliability and construct validity (Table 2). All factors aligned with Super's theory achieved adequate internal reliability ($\alpha = 0.76$ to 0.81). A high degree of internal consistency among the items was shown by a CCA level of 0.85 for the inventory. The removal of any individual items from all factors caused the CCA to decrease, thus, all items were important in measuring readiness in the questionnaire.[12]

A Pearson's correlation was conducted between the items and factors of the questionnaire, including demographic characteristics to establish construct validity (Table 3). The relationship among the three scales themselves was significant and positive, but not too high to indicate multicollinearity ($r = 0.44$, 0.32 and 0.33, $p < 0.001$). The scales were moderate to highly correlated to the XTRA composite score (SQ) ($r = 0.74$, 0.70, 0.82, $p < 0.001$) indicating a degree of uniqueness on measuring specific dimensions of the scale. The three scales and the composite score of the instrument (SQ) were significantly correlated to the perception of readiness of participants (SR), ($r = 0.45$, 0.49, 0.41). Similarly, higher scores correlated significantly with students rating of their familiarisation with foundation training ($r = 0.32$, 0.26 and 0.30) and specialty training pathways ($r = 0.43$, 0.41, and 0.31). This demonstrates that all factors were essential in medical career readiness.

5 | IMPLICATIONS

There is a need for improved career readiness among medical students as it contributes to timely development of the future professional workforce. Super's theory provides a framework of career maturity that can be adapted to the medical field. Findings suggest that the XTRA inventory is conceptually and psychometrically robust, and measures career readiness for a population of medical students encountering a common set of vocational development tasks. The inventory could potentially be used by medical schools for career counselling purposes and individually, to identify gaps and design interventions aimed at helping students develop their medical portfolio and career.

Findings suggest that the XTRA inventory is conceptually and psychometrically robust.

According to Super's theory,[7] we anticipated that three factors would account for career readiness, and found that a 16-item

TABLE 1 Exploratory Factor Analysis of the items from the XTRA Inventory. *Loadings larger than 0.5 are in bold.*

Items	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Introspection (Crystallisation)					
1. I have clearly defined my values and passions	0.77	0.10	0.07	0.11	0.01
2. I have thoroughly defined my life goals	0.75	0.09	0.08	0.08	−0.05
3. I have fully reflected on my personal attributes as a professional	0.70	0.06	0.07	0.34	0.13
4. I have fully understood my strengths and weaknesses	0.68	0.21	0.12	−0.00	0.05
5. I have thoroughly envisioned how my career might look like in 5+ years time	**0.44**	0.03	0.14	**0.59**	0.04
Insight into Working Life (Specification)					
6. I clearly understand a doctors working rota and employee entitlements	0.12	**0.79**	0.01	0.17	0.07
7. I clearly understand the financial aspects of a doctors career	0.04	**0.76**	0.03	0.26	0.20
8. I clearly understand how to network with other medical professionals	0.40	**0.55**	0.26	0.07	0.12
9. I fully understand the skills I need to develop as a doctor	0.28	**0.52**	0.25	−0.06	−0.30
Portfolio Development (Implementation)					
10. I have experience in authorship of a PubMed-cited study	0.01	0.05	**0.48**	0.15	**0.50**
11. I have teaching experience	−0.04	0.04	**0.68**	0.12	0.13
12. I have leadership experience	0.19	0.22	**0.70**	−0.02	0.09
13. I have experience with prizes and awards	0.19	−0.04	**0.74**	0.07	0.15
14. I have experience of courses and conferences	0.20	−0.09	**0.62**	0.24	0.24
15. I have experience in quality improvement projects	−0.07	0.06	**0.61**	0.21	0.15
16. I have experience of using social media effectively	0.15	0.24	**0.60**	−0.02	−0.10
Medical Training Pathways					
17. I have fully familiarised myself with specialty training pathways	0.15	0.25	0.14	**0.83**	0.05
18. I have fully familiarised myself with foundation training pathways	0.08	0.14	0.19	**0.81**	−0.00
Accomplishments Outside of Medicine					
19. I have experience of an additional degree	0.04	−0.03	0.15	0.03	**0.75**
20. I have experience of opportunities in entrepreneurship	0.07	0.27	0.22	−0.03	**0.67**
Eigenvalue	2.29	1.46	5.41	1.40	1.11
Percentage of variance explained	11.42	7.27	27.03	6.99	5.55
Cumulative percentage of variance explained	38.45	45.73	27.03	52.72	58.27
Percentage of rotated variance explained	13.59	10.61	15.75	10.40	7.92
Cumulative percentage of rotated variance explained	29.35	39.95	15.75	50.35	58.27
Cronbach's coefficient alpha	0.76	0.71	0.81	0.81	0.39

TABLE 2 Mean, Standard Deviation (SD) and Cronbach alpha (*a*) for each scale.

Factors	Item (N)	Minimum Points	Maximum Points	Midpoint	Mean	SD	α
Crystallisation	1–5 (5)	5	25	15	15.72	4.00	0.76
Specification	6–9 (4)	4	20	12	10.64	3.28	0.71
Implementation	10–16 (6)	6	30	18	15.44	5.83	0.81
Training Pathways	17–18 (2)	2	10	6	5.64	2.28	0.81
Accomplishments Outside of Medicine	19–20 (2)	2	10	6	4.00	1.93	0.39
Self-Rating of Readiness	21 (1)	1	5	3	2.76	1.16	NA
Super's Readiness Scale (Total)	1–16 (16)	16	80	48	41.79	9.76	0.85

TABLE 3 Scale and variables inter-correlation of the XTRA Inventory.

Items	C	S	I	FP	SP	AD	E	A	G	Y	GR	L	SQ	SR
Crystallisation (C)	1													
Specification (S)	0.44**	1												
Implementation(I)	0.32**	0.33**	1											
Foundation Pathways (FP)	0.32**	0.29**	0.30**	1										
Specialty Pathways (SP)	0.43**	0.41**	0.31**	0.68**	1									
Additional Degrees (AD)	0.65	0.09	0.29**	0.13*	0.11*	1								
Entrepreneurship (E)	0.15**	0.26**	0.38**	0.13*	0.16**	0.30**	1							
Age (A)	0.09	0.01	0.18**	0.12*	0.17**	0.42**	0.22**	1						
Gender (G)	−0.04	−0.08	−0.06	0.01	−0.10	0.014	−0.04	−0.10	1					
Year (Y)	−0.05	−0.02	0.21**	0.08	0.02	0.18**	−0.19**	−0.32**	0.00	1				
Graduate (GR)	−0.28	−0.02	−0.05	0.05	0.06	−0.25**	0.10	0.43**	0.02	−0.06	1			
Location (L)	0.34	−0.04	0.04	0.05	0.04	−0.18**	0.01	0.14**	−0.06	0.07	−0.18**	1		
Super's Questionnaire (SQ)	0.74**	0.70**	0.82**	0.40**	0.48**	−0.22**	0.36**	0.15**	−0.08	0.13*	−0.05	0.03	1	
Self-rating of readiness (SR)	0.45**	0.49**	0.41**	0.36**	0.37**	0.13**	0.17**	0.28	−0.15**	0.02	−0.05	0.09	0.57**	1

*Correlation significant at the 0.05 level (two-tailed).
**Correlation significant at the 0.001 level (two-tailed).

questionnaire may be sufficient for examining the goals of students in relation to career readiness. Contrary to our expectations, four items loaded on two separate factors outside of Super's theory, and one possible explanation for this may be the unique UK context of our evaluation. In the UK, medical school graduates continue their post-graduate clinical training in the Foundation Programme followed by specialty training or general practice training.[13] Items 17 and 18 measured the understanding of these pathways, which in this inventory was specific to a career in the UK. International authors can adapt the items with any pre-specialty training (e.g. internship training in the United States) and further research will help explore whether Super's theory should be expanded upon in order to capture a more contemporary career in medicine.

Similarly, the items measuring entrepreneurship and additional degrees could be further explored, given the recent tendency to invest in innovation in the healthcare setting,[14] and the positive impact of additional degrees on medical careers.[15] Some may argue that additional accomplishments are far broader and activities such as sport, music and charitable roles could expand and contribute towards career constructions. Additionally, further studies with the inventory may wish to stratify the different qualifications (e.g. Masters, PhD, BSc) to ascertain the relative benefit of each.

While the sample size in this study was appropriate, it was relatively small compared to the UK medical student cohort. Furthermore, our sampling may have unintentionally resulted in a higher proportion of students coming from restricted networks—therefore limiting generalizability. The two factors outside of Super's domain were also unexpected and could be further developed in future studies to improve the conceptual framework. Finally, predictive validity has not been considered, yet the value of the inventory is largely dependent on important outcome measures associated with career readiness.

Further work on its construct and predictive validity will help establish an inventory to be used as a guidance and career counselling tool, by medical educators and educational institutions. More specifically, we envision the tool to be administered during students' transitions (1) to medical school, where self-awareness of career goals can aid planning; (2) from preclinical to clinical years, which aligns with the period in which students typically begin contemplating their future career paths with more insight; and (3) from medical school to clinical practice, when there is more certainty of career choices and what next steps could be needed. Following such assessments, results can be used by students to reflect on their own strengths, identify areas for improvement, and set tailored goals for their career development. Moreover, the improved inventory can be incorporated into a broader professional development curriculum, where students can actively engage with ongoing self-assessment and goal-setting exercises. By creating a feedback loop, this will hopefully empower students to take an active role in shaping their career trajectories and cultivating the necessary competencies for success in the medical profession.

Further work on its construct and predictive validity will help establish an inventory to be used as a guidance and career counselling tool, by medical educators and educational institutions.

CONSENT FOR PUBLICATION

All authors take responsibility for all aspects of the reliability and freedom from bias of the data presented and their discussed interpretation for publication.

CONFLICT OF INTEREST STATEMENT

The work behind this research was inspired by a project conducted by PB and AG who were the co-founders of an online career development programme (Medschool Xtra™). CC, FV, MM and AM participated in the programme by collecting feedback on the seminars. AG, CC, FV and MM no longer have relationships that could be construed as a conflict of interest. MHVB and MT have no conflict of interest to declare.

AUTHOR CONTRIBUTIONS

AG, PB and MT were responsible for conceptualisation. AG, FV, CC, MM, AM were responsible for writing the protocol of the study. AG, MT and MHVB were responsible for study design. MT and MHVB provided academic leadership. MM, CC and FV were responsible for leading the data collection, and AG, CC and FV undertook data analysis. AG, MM, CC and FV wrote the first draft of the paper. All authors were responsible for revisions. MT was responsible for supervision.

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DATA AVAILABILITY STATEMENT

Data will be available on request on a case-by-case basis.

ETHICS STATEMENT

Ethical approval was granted by the Cardiff University Research Ethics Committee (Reference: SMREC 21/86) prior to commencing the study. Participants provided informed consent for the use of anonymised responses for publication purposes.

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