

# Global Competence of Medical Students: An Assessment Scale and Preliminary Investigation in China

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**Research article**

**Keywords:** Global competence, Assessment scale, Medical education

**Posted Date:** November 18th, 2019

**DOI:** <https://doi.org/10.21203/rs.2.16421/v2>

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# Abstract

**Background:** The importance of global competence has been acknowledged in medical care as well as medical education. However, the existing definition of global competence and the survey tools used to assess global competence are not fully applicable to medical students. This study developed and validated a questionnaire assessing the global competence of medical students and preliminarily explored the underlying factors influencing the global competence of Chinese medical students in eight-year programs. **Methods:** A questionnaire (Global Competence Assessment Scale for Medical Students, MS-GCAS) was developed following a systematic process, and a cross-sectional multicenter survey was conducted among 10 medical schools in China. A total of 1062 completed questionnaires were analyzed. **Results:** The analysis revealed a four-factor scale consistent with the proposed structure according to the definition of global competence. The validity estimates of the four subscales were mostly satisfactory. School education, duration of overseas exchange programs and willingness to work abroad were found to have significant correlations with global competence. **Conclusions:** The MS-GCAS is valid and reliable for the assessment of the global competence of medical students in China. Medical schools should take further steps to promote medical students' global competence.

## Background

Global competence is a comprehensive capacity involving individual skills, knowledge, attitudes, and values that prepare the young to thrive in the interconnected world. In 2018, the Organization for Economic Cooperation and Development (OECD) added global competence to the Program for International Student Assessment (PISA) test for the first time. The definition of this multidimensional capacity from the OECD PISA, as shown in Figure 1, emphasizes individuals' capability to examine local, global or intercultural issues; recognize and respect others' mindsets and conceptions of the world; openly and adequately interact with people who have diverse cultural backgrounds; and take action for mutual welfare as well as sustainable development(1).

In the field of medical care and medical education, comprehensive qualities, especially cultural competence, have captured attention. Researchers believe that cultural competence training should be a part of medical school education programs to help trainees effectively address diverse cultural issues in their future work(2). This competence has been considered by the World Federation for Medical Education (WFME) when developing international standards for further medical education improvement(3). An increasing number of medical schools have also recognized the significance of global competence, which broadens the focus on cultural difference to emphasize inclusive international issues. A new round of general education reform at Harvard Medical School(4) includes the preparation of courses to develop students' global competence.

A healthcare system with a global view is beneficial for the well-being of humankind(5). Medical students, as well as doctors, should develop their global competence to address global challenges and offer high-quality care for patients with diverse backgrounds. Literature studies on medical students' international

communication skills and doctors' cultural competence(6-8) have been conducted, yet there is no clear definition or appropriate assessment of global competence. In fact, refining the definition to fit a specific target group and conducting reliable assessments are necessary but challenging work(9).

We designed a scale to assess medical students' global competence. A questionnaire study was then performed to determine the applicability of the questionnaire among Chinese medical students from eight-year programs. Moreover, the collected data were analyzed to explore several potential factors that may be relevant to medical students' global competence.

## Methods

### *Study Design*

This study was designed following the Association for Medical Education in Europe (AMEE) Guide No. 87 published in *Medical Teacher*(10). The overall study flowchart is shown in Figure 2.

A literature review was conducted first to establish the definition of global competence for medical students. Then, we randomly selected 20 medical students from eight-year clinical medicine programs in the top medical schools in China and asked them about their definitions of global competence for medical students(11). Four dimensions of the definition of global competence for medical students were established based on the results. The first draft of the scale had a balanced number of items for each of the four dimensions. The items in our scale were developed based on the official manuals of *the OECD PISA Global Competence Framework*(12) and relevant scales assessing the cultural competence of medical professionals(7, 13). Validation was received from 6 experts in the fields of medical education, statistics, psychology and international education at Tsinghua University and Peking Union Medical College. Details of the target group specialization, item revision, questionnaire wording and statistical methods(14) were established. Another 20 medical students from the target population were then consulted to ensure that the item expressions were unambiguous for medical students in different grades.

In the pilot test, the first draft of the questionnaire was administered to 206 respondents from the target group. Based on the feedback from the student interviews and the expert consultations, the eight-year clinical medicine program was divided into four stages: premedical courses, basic medicine courses, clinical courses, and clinical clerkship. Equal numbers of students from each stage completed the online questionnaire. Exploratory factor analysis(15) was conducted, and Cronbach's alpha was calculated to ascertain the internal construct validity and the internal consistency reliability of the MS-GCAS. The factor analysis showed a model with four principal components based on 21 items (Additional file 1). The items were then further refined or deleted from the model to obtain a better fit and better internal consistency. Univariable linear regression and multivariable linear regression were performed to determine the factors related to global competence. School education, willingness to go abroad and participation in overseas programs were found to be the top three factors that were highly correlated with the MS-GCAS score. These factors were investigated in the final version of the questionnaire.

The pilot test showed that the respondents had no difficulty reading, comprehending or answering the questions. We referenced the results of the pilot test to adjust the first draft of the questionnaire. The final questionnaire (Additional file 2) was distributed to 1062 respondents in the target group.

### ***Participants and Data Collection***

This cross-sectional multicenter survey involved ten medical schools in eight cities in China. All of the schools are among the top medical schools providing high-quality eight-year clinical medicine education programs. Thirteen students were invited to administer the MS-GCAS questionnaires at these colleges. The questionnaires were distributed online via WeChat, and all responses were anonymous. The Chinese version of the questionnaire was used in the survey, which was approved by the Institutional Review Board (IRB) of Peking Union Medical College Hospital.

Data were collected from December 2018 to January 2019 through online questionnaires randomly distributed to clinical medical students in eight-year clinical medicine education programs. Oral informed consent was obtained from each participant after the researcher explained the objectives of the survey and noted that the collected data would be used only for academic purposes. The authors had no access to participants' identities during or after the data collection.

### ***Statistical Analysis***

All statistical analyses in this study were performed with SPSS version 25.0. Principal component analysis with varimax rotation and exploratory factor analysis were used to examine the internal structure of the MS-GCAS. The internal consistency reliability was ascertained by Cronbach's alpha. The Shapiro-Wilk test was used to test for normal distribution of the continuous variables. To investigate the predictive factors of the MS-GCAS score, both univariable and multivariable models were constructed. The associations between the predictors and the MS-GCAS score were investigated by Pearson correlation analyses. All predictors of the MS-GCAS score in the univariable analysis were included in a generalized multivariable linear model.

## **Results**

### ***Scale construction***

The A, B, C, and D items refer to questions corresponding to the four dimensions of the definition of global competence on the MS-GCAS (Figure 1): the capacity to examine local, global and intercultural issues (A1-A6); to recognize and respect others' mindsets and conceptions of the world (B1-B4); to openly and adequately interact with people who have diverse cultural backgrounds (C1-C5); and to take action for mutual welfare as well as sustainable development (D1-D5). The scoring procedures and specific scoring information for each item are shown in Additional file 3. The distribution of the different responses to each MS-GCAS item is shown in Figure 3.

## ***Participant Profiles***

The questionnaires were administered in 10 medical schools in China: Peking Union Medical College, Peking University Health Science Center, Xiangya School of Medicine (Central South University), Tongji Medical College (Huazhong University of Science and Technology), Southern Medical University, Shanghai Medical College of Fudan University, West China Medical Center (Sichuan University), Shanghai Jiao Tong University School of Medicine, Zhejiang University School of Medicine and Zhongshan School of Medicine. A total of 1062 valid questionnaires were collected, and the number of respondents from each college was balanced: the maximum number was 124 (Peking Union Medical College), and the minimum number was 83 (Xiangya School of Medicine, Central South University). Table 1 presents the respondents' characteristics. Among the participants, 459 (43.2%) were male, and 603 (56.8%) were female. Students currently in the premedical course, basic medicine course, clinical skills course, and clinical practice and internship phases constituted 29.8%, 27.5% and 22.5% and 20.2% of the participants, respectively. In terms of academic grade ranking, 40.5% of the participants were in the upper 1/3, and 43.5% were in the middle 1/3. The participants had been provided with various types of exchange programs, including clinical exchange, scientific research exchange, and public health exchange. A total of 85.5% of the participants had participated in at least one exchange program, and the popular exchange destinations included the US, Canada, the UK, Hong Kong, etc. More background information on the participants' exchange experiences is presented in Additional file 4.

## ***Construct Validity***

An exploratory factor analysis was run on 21 items, and the results are shown in Table 2. The scree plot showed a hitch on the fifth factor; therefore, a four-factor solution was formulated, which explained 55.956% of the total variance. The initial eigenvalues of the components were 5.880, 2.436, 1.663 and 1.212. After rotation, the factors explained 17.834%, 16.524%, 14.813% and 6.787% of the variance.

To better interpret the factors, factor loadings larger than 0.50 are presented in shadows. The items with the highest factor loadings on the first factor were the six items concerning the ability to consider other people's perspectives and behaviors from multiple perspectives (B1-B4) and the ability to deliver high-quality care to patients with diverse needs and backgrounds as well as flexibly adapt one's behaviors and communication to different cultures (C1, C2). The first factor represented dimensions A and B of the definition of global competence. These two dimensions are strongly interdependent by definition because communicating in open, appropriate, and effective ways requires recognition and respect of different cultural values or beliefs. The second factor involved aspects concerning young people's active and responsible roles in society (D1-D5). The third factor focused mainly on the capability to effectively form one's own views on the environmental, social and economic determinants of global health issues by drawing on one's knowledge of the world (A1-A6). The fourth factor consisted of three items related to language level and communication frequency with people from other countries (C3-C5).

## ***Reliability***

The reliability of the 21-item MS-GCAS was high, with a Cronbach's alpha of 0.856. The Cronbach's alphas of the four factors identified in Table 2 were 0.852, 0.874, 0.787 and 0.335.

### ***Analysis of the Correlates of the MS-GCAS Score***

The analysis of the associations between the different variables and the MS-GCAS score are shown in Table 3. School education plays an essential role in medical students' global competence development, as it can provide overseas study opportunities and teach students how to stay informed and critically think about important issues related to global health. Schools foster students' appreciation for diverse communities, languages, and culture by encouraging intercultural activities. Therefore, we developed an 8-item scale (Additional file 5) based on official manuals(12) and literature reviews(2, 16) for the preliminary evaluation of the effect of school education on global competence. In the univariable analyses (n = 1062), gender ( $p < 0.001$ ), willingness to go abroad ( $p < 0.001$ ), overseas program duration ( $p = 0.002$ ), grade ranking ( $p < 0.001$ ) and school education score ( $p < 0.001$ ) were found to be significant predictors of the MS-GCAS score (Table 3).

### ***Multivariable Regression***

In the multiple regression analyses (Table 4), school education score, willingness to go abroad, overseas program duration and grade ranking were positively associated with the MS-GCAS score ( $R^2 = 0.171$ ).

Students with higher grade rankings (those in the upper 1/3) had better results than those with lower rankings (those in the middle 1/3 and lower 1/3), as shown in Table 3. The upper 1/3 group had the highest scores on subscale A ( $15.23 \pm 3.05$ ,  $p < 0.001$ ), subscale B ( $17.60 \pm 2.31$ ,  $p < 0.001$ ) and subscale C ( $16.84 \pm 2.53$ ,  $p < 0.001$ ). In particular, students in the upper 1/3 group had significantly higher scores on subscale D ( $20.65 \pm 3.83$ ) than those in the middle 1/3 group ( $18.55 \pm 3.83$ ) and the lower 1/3 group ( $17.20 \pm 4.43$ ), with a p-value less than 0.001. Therefore, school education has a strong correlation with students' capacity to take action for mutual welfare and to build a more just, peaceful, inclusive and environmentally sustainable world. Courses related to social activity organizing skills are recommended in Chinese eight-year clinical medical programs to encourage students to initiate and take part in global health campaigns. Students should realize that they can have multiple influences on health development from the local to the global levels.

## **Discussion**

An enormous challenge in assessing medical students' global competence is in the complex questionnaire design in a constricted context. The MS-GCAS is a pioneering tool for the global competence assessment of clinical medical students. A large number of interviews and literature studies were conducted to ensure that the items on the MS-GCAS questionnaire are applicable to clinical medical students at different academic stages in medical schools in China. The MS-GCAS emphasizes four dimensions of global competence as a comprehensive capacity involving skills, knowledge, attitudes, and values (Figure 1). These dimensions and items that need to be addressed according to this work are

supported by previous studies(12, 17-19). Nevertheless, this work can be distinguished from previous work because it included diverse cities in a multi-center survey and highlighted global competence as involving more than just cultural ability; it also focused on the context of medical education and included a pilot test of the questionnaire among medical students in China.

The design of the MS-GCAS was based partly on a general global competence assessment, but various items for healthcare were developed to make the scale suitable for medical students. Situational questions have been introduced in several surveys, and specific scenes describing cultural issues, behaviors or values have been used to fully evaluate individuals' capabilities. However, it takes respondents more time to complete these questionnaires, and attention should be paid to the quality of the situation settings. In this regard, the MS-GCAS is rather concise, which allows further adjustment for specific circumstances.

In previous studies, plans for working abroad or migration, school education, language barriers, intergroup contact, acculturation strategies and awareness of the importance of global competence were reported to be correlated with students' global competence development(6, 20-23). The above factors were considered in this work. According to the results of the multiple regression model, the academic grade ranking was also found to be relevant to global competence, and further study is required to evaluate the precise interrelationship. The analyses in this study showed that school education plays the most significant role in the development of global competence. This role has been noted by educators. An increasing number of educational institutes are redesigning their curricula to cultivate students' global competence(16, 24), and questionnaires have been developed to assess global competence. An objective structured clinical examination (OSCE) station was established in America to evaluate students' skills when treating patients with diverse cultural backgrounds (20, 24). Several medical schools in China have also started educational programs for medical English training and the promotion of doctor-patient communication(6).

Our study also had several limitations. First, all the participants in this study were from eight-year clinical medicine education programs in China, which limits the generalizability of our findings. Despite this limitation, the research results can illustrate the current situation of medical education in China, as eight-year clinical medical education programs are among the most representative medical school training programs in China. Second, the individual Cronbach's alpha of the fourth factor was 0.335, which requires further optimization. Third, the linear regression model applied only the predictors found to be significant in univariable analysis, which may have led to model overfit. Fourth, only a few underlying factors were preliminarily explored. More research is required to analyze the other factors affecting global competence. Fifth, no general programs for global competence in the field of medical education have been formally promulgated. Further surveys can be conducted among both educators and students to guide reform and promote global competence.

## Conclusions

The MS-GCAS showed satisfactory validity and reliability in assessing the global competence of medical students in China. Our survey found that global competence development is closely related to the content of school education. In the future, medical schools should conduct further educational reforms to promote students' global competence.

## **Abbreviations**

MS-GCAS: Global Competence Assessment Scale for Medical Students.

## **Declarations**

### ***Acknowledgements***

The authors would like to thank the Asian Medical Students' Association-China (AMSA-China) for assistance with the data collection for this work. Special thanks are offered to Yuanzhi Guan (Chinese Academy of Medical Sciences & Peking Union Medical College), Jianbo Lv (Tongji Medical College, Huazhong University of Science and Technology), Jiayi Shen (Zhongshan School of Medicine), Yanzhi Pan and Yuanzhi Gao (Zhejiang University School of Medicine) for their kind help during the research.

### ***Authors' Contributions***

YS and HD contributed to all phases of the study, from conceptualizing the idea to submission of the manuscript to BMC Medical Education. YF and YC formulated the research idea, performed the statistical analysis, edited the draft and wrote the manuscript. HZ, YD, YZ, LZ, PL, SC, TL, NC, and HW participated in the discussion of the methods and helped collect the data. JZ supervised the entire study and provided constructive suggestions. All authors approved the final manuscript.

### ***Funding***

Peking Union Medical College's Education and Teaching Reform Project grant #2016zlgc0131.

### ***Availability of the Data and Materials***

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

### ***Ethics Approval and Consent to Participate***

This study was approved by the Institutional Review Board (IRB) of Peking Union Medical College Hospital (PUMCH) on December 14<sup>th</sup>, 2018. Oral informed consent was obtained from each participant after the researcher explained the objectives of the survey and noted that the collected data would be used only for academic purposes.

### ***Consent for Publication***

Not applicable.

### ***Competing Interests***

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the article.

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## Tables

**Table 1.** Demographic characteristics of the 1062 participants.

Characteristics	Total (%)
<b>Gender</b>	
Male	459 (43.2)
Female	603 (56.8)
<b>Stage in medical school</b>	
Premedical courses	316 (29.8)
Basic medicine courses	292 (27.5)
Clinical courses	239 (22.5)
Clinical clerkship	215 (20.2)
<b>Overseas study experience</b>	
None	911 (85.8)
At least once	151 (14.2)
<b>Overseas program type</b>	
Clinical exchange	55 (29.6)
Scientific research exchange	44 (23.7)
Public health exchange	15 (8.1)
Course exchange	31 (16.7)
Others	41 (22.0)
<b>Grade ranking</b>	
Upper 1/3	430 (40.5)
Middle 1/3	462 (43.5)
Lower 1/3	170 (16.0)

**Table 2.** Survey analysis results for the items in the four subscales of the MS-GCAS for the 1062 participants.

Item number	Item	Factor loadings*				$\alpha$
		1	2	3	4	
B3	I give space to people from other cultures to express themselves.	0.808	0.162	0.091	0.083	0.852
B4	I respect people from other cultures as equal human beings.	0.764	0.220	0.048	0.030	
B2	I believe that there are two sides to every question and try to look at them both.	0.741	0.114	0.095	0.101	
B1	I try to look at everybody's side of a disagreement before I make a decision.	0.693	0.116	0.161	0.055	
C1	I deliver high-quality care to all patients, regardless of race, religion and other beliefs or practices, and I am informed by the best available evidence.	0.668	0.285	0.021	0.023	
C2	If there is a problem with communication, I find ways around it (e.g., by using gestures, re-explaining, and writing).	0.664	0.261	0.097	-0.119	
D4	I enjoy organizing activities to enable transnational advocacy about health issues.	0.200	0.849	0.080	0.089	0.874
D2	I enjoy organizing activities to popularize scientific knowledge to improve public health.	0.218	0.780	0.160	0.080	
D5	I pay attention to solutions of for global governance (e.g., solutions to global health emergencies and the long-term development of medical systems).	0.127	0.742	0.221	0.049	
D1	I enjoy taking part in activities organized by communities/universities and hospitals to popularize scientific knowledge.	0.285	0.733	0.173	0.030	
D3	If there is an opportunity, I would love to join in international volunteer activities organized by international organizations.	0.323	0.717	0.030	0.064	
A5	The impact on health of cross-border flows, including international trade, information and communications technology, and health worker migration.	-0.064	0.203	0.739	0.053	0.787
A6	Health-related cultural beliefs of people from different cultural backgrounds.	0.011	0.168	0.727	-0.017	
A4	The impact on health of different political and economic systems.	0.068	0.080	0.701	0.151	
A3	The Chinese healthcare service structure and the undergoing reform of the Chinese medical system.	0.123	-0.008	0.644	0.200	
A2	The impact of global climate change on human health.	0.106	0.138	0.625	-0.031	
A1	The distribution and variation of major communicable diseases.	0.276	0.024	0.624	0.060	
C3	What is your English level? (Reference to CET-6)	0.111	0.046	-0.004	0.710	0.335
C5	How often do you have contact with people from other countries?	-0.020	0.158	0.165	0.686	
C4	How many foreign languages have you learned?	0.011	0.003	0.082	0.504	
<b>Initial eigenvalues</b>		5.880	2.436	1.663	1.212	<b>Overall</b>

\* Factor loadings over 0.5 are presented in italics.

**Table 3.** Univariable linear regression analysis of the MS-GCAS score, participants' demographic characteristics and potential influencing factors.

Variable	B (95% CI)	P value
Gender	2.617 (1.606, 3.628)	<0.001
Stage in medical school	-0.068 (-0.527, 0.390)	0.771
Willingness to go abroad	1.845 (1.225, 2.464)	<0.001
Overseas program duration	0.763 (0.291, 1.235)	0.002
Grade ranking	-1.500 (-2.207, -0.792)	<0.001
School education score	0.595 (0.498, 0.693)	<0.001

**Table 4:** Multivariable linear regression models of the relationships of the MS-GCAS score with the characteristics of medical students.

	B (95% CI)	P value
Gender	1.979 (1.035, 2.922)	<0.001
Stage in medical school	0.396 (-0.055, 0.847)	0.085
Willingness to go abroad	1.061 (0.470, 1.652)	<0.001
Overseas program duration	0.496 (0.037, 0.956)	0.034
Grade ranking	-1.228 (-1.889, -0.568)	<0.001
School education score	0.578 (0.479, 0.677)	<0.001

## Additional File Legends

Additional file 1.pdf

Results of the analysis of the four subscales of the MS-GCAS from the pilot test among 206 medical students.

### **Additional file 2.pdf**

Questionnaire assessing global competence.

This questionnaire is designed to assess the global competencies of the top 13 medical universities in China.

### **Additional file 3.pdf**

Results for the MS-GCAS items.

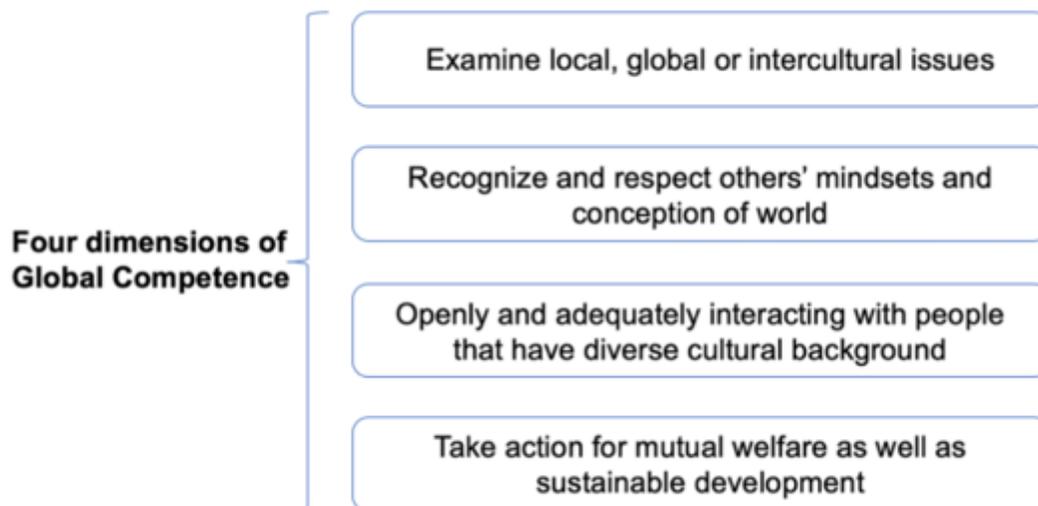
### **Additional file 4.pdf**

Background information on overseas study programs.

### **Additional file 5.pdf**

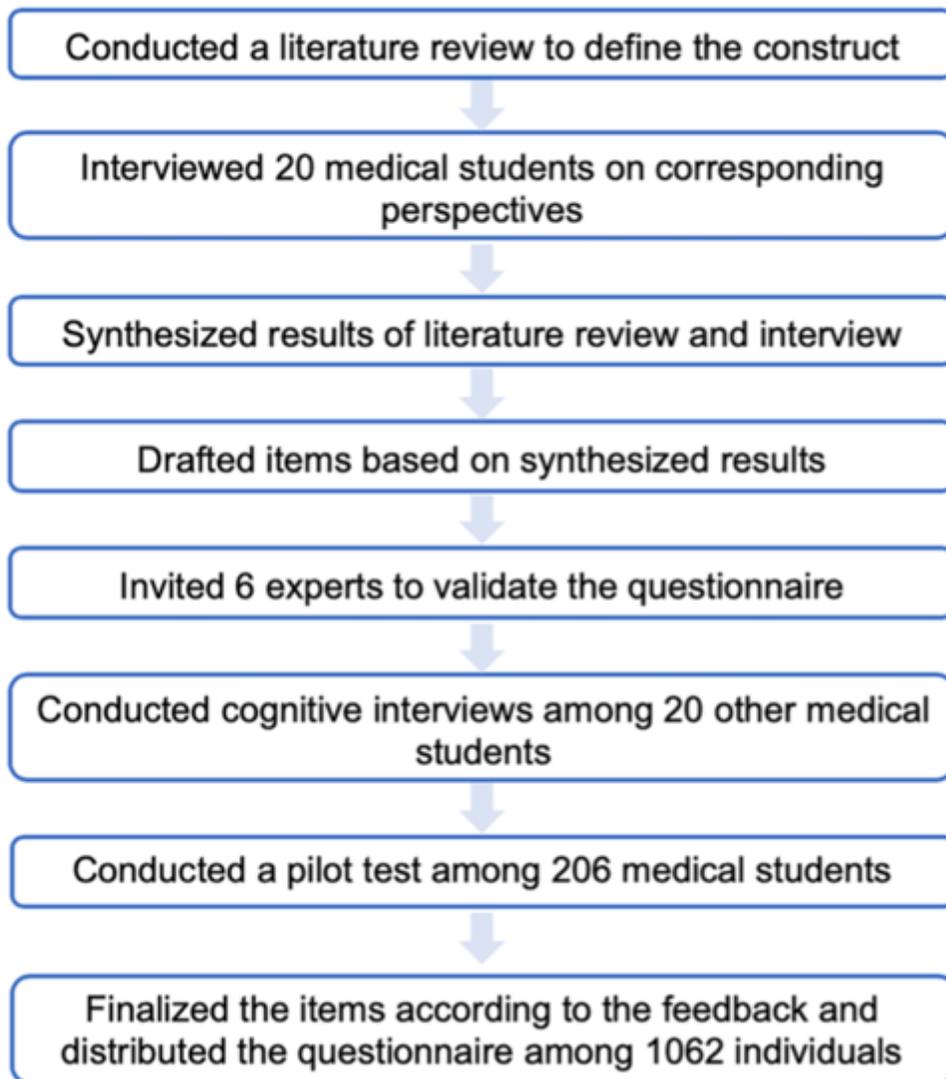
Eight-item scale on school education.

## **Figures**



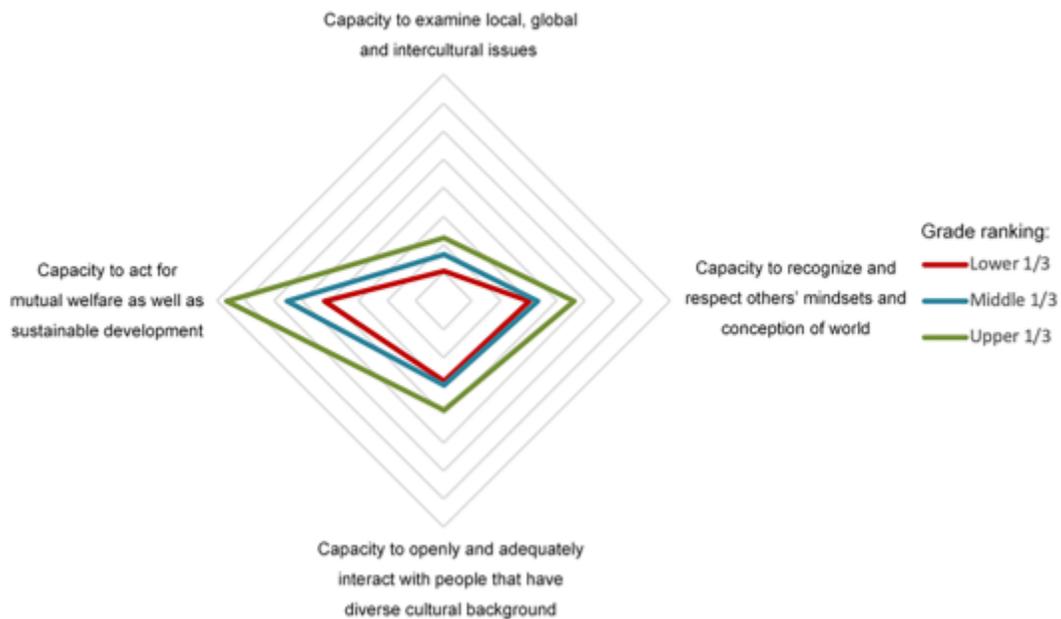
**Figure 1**

Conceptual model of Global Competence derived from the OECD PISA Global Competence framework.



**Figure 2**

Flowchart of the establishment of the questionnaire assessing Global Competence of medical students.



**Figure 3**

Spider plot of the MS-GCAS subscale scores with different grade rankings. Each subscale of the MS-GCAS scores varies in the lower 1/3, the middle 1/3 and the upper 1/3 students according to school education scores.

## Supplementary Files

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