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Development and Validation of an Emotional Intelligence Test for Medical Students

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Authors' contributions

This work was carried out in collaboration between both authors. Both the authors contributed equally to the paper. Both authors read and approved the final manuscript.

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ABSTRACT

Aims: Emotional intelligence is an important ability that has to be fostered among medical professionals. To foster an ability, it has to be assessed. The tests/tools already available are culture-sensitive and context-sensitive. Hence there is a need to develop a test to assess the emotional intelligence abilities of medical students. This paper describes a multiphase study in which an instrument was developed to assess the emotional intelligence of medical students.
Study Design: The study was done in four phases. The first three phases were to develop the instrument and establish its reliability and validity. The fourth phase was to demonstrate the predictive validity of the developed instrument.
Place and Duration of Study: A private teaching hospital in South India; Two years.
Methodology: In the first phase, the emotional challenges of medical students (n =55) were understood to develop the situations for the situational judgment tests. In the second phase, the instrument was developed with 38 items contributing to the constructs of EI. In the third phase, a pilot study was conducted, in which the developed tool was administered on a sample of 150 medical students. The data was used to verify the content validity, construct validity, internal consistency reliability (0.8), and predictive validity. In the fourth phase (n = 102) the test-retest reliability (with a ten-month interval between the tests) and the predictive validity (established by studying the association between EI measured with the tool and the academic performance of

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respondents) of the purified instrument were studied.
Results: A tool to assess the EI of medical students was developed. The tool demonstrated test-retest reliability (0.6) and predictive validity (r = 0.29; *P* < .01).
Conclusion: The tool would provide a premise for the development of training programs and their inclusion in the medical curriculum, which in turn would yield medical professionals who can deliver enhanced patient care. The study also showed the impact of EI on the academic achievement of medical students and hence their knowledge and skills will also be improved by including EI in their curriculum.

Keywords: Emotional intelligence test; development; validation; medical students; situational judgment test.

1. INTRODUCTION

Mayer and Salovey [1] coined the term Emotional Intelligence (EI) and Daniel Goleman [2] popularized the concept through his book "Working with Emotional Intelligence". EI is said to play an important role in both personal and professional fronts. In the organizational context, EI facilitates a healthy work culture and influences the performance of individuals, teams, and the organization as a whole, yielding competitive advantage [3].

Emotional intelligence has been identified as an important skill for health care professionals [4,5]. The academic and clinical performance of medical professionals was found to be influenced by EI [6]. In the medical practice, EI was found to improve the empathy of professionals, thereby resulting in improved doctor-patient relationships and patient satisfaction [7-12]. Higher EI was found to be positively associated with compassionate and empathetic patient care [13], effective coping with organizational pressures [14], and leadership, improved teamwork, and doctor-patient communication skills and professionalism [15]. Many studies have found that emotional intelligence fosters a patient-doctor relationship [16,17].

The studies that brought out the importance of EI for medical professionals have encouraged medical schools to focus on the interpersonal competencies of medical students, specifically EI. The research studies also encourage that the EI of medical students be assessed and developed before they graduate [18]. To instill professionalism, Webb and colleagues [5] urged that medical schools impart EI training to their students so that their interpersonal and communication skills are enhanced. From the review it is clear that medical schools can recruit students with high EI for the medical courses, to leverage on the benefits yielded by high EI [19]. Given the importance of EI in the medical community and the need to recruit individuals with high EI, there is a need to measure the emotional intelligence of medical students.

EI of individuals differs across cultures and contexts. There are a few measures of EI in the Indian context [20,21]. However, they are used to measure the EI of different audiences based on different premises of EI [3]. A test was developed to assess the EI of adults in the work environment of Indian organizations [22]. A literature review revealed the presence of a scale for assessing the EI of medical students [23], which is based on the Emotional Competence Inventory (ECI). The use of this scale was not reported. Wong and colleagues [24] had brought out the need for an easily administered instrument that could measure emotional competence and its development in higher education settings. Thus emerges the need for developing an instrument to assess the EI levels of medical students. With this problem definition, the study aims to develop and validate an instrument to assess the Emotional intelligence levels of medical students.

2. LITERATURE REVIEW

Mayer and Salovey [1] defined EI as the ability to understand one's own and others' feelings and use this to guide their behavior for better outcomes. Apart from this definition, there are various conceptualizations of EI, which can be broadly classified into ability models and mixed models [25]. The ability models look at EI as an ability to manage emotions intelligently for beneficial outcomes. The mixed models posit EI as a set of non-cognitive abilities. Research indicates that both ability and mixed models of EI have conceptual and methodical problems [26]. Studies found that these two models are not measuring the same construct [27,28]. The constituents of EI as per the mixed models did not correlate with cognitive ability. However, they

correlated highly with personality [29-32]. In contrast to this, the constituents of EI as defined by the ability models correlated strongly with cognitive ability, but weakly with personality [28]. Brackett and Mayer [33] also found that ability and mixed models of EI are weakly related and yield different measurements of the same person.

Daus and Ashkanasy [34] have mentioned about three streams of EI. The first stream is based on the ability model of Mayer and Salovey [1] and uses their test to measure EI; the second is also based on the ability model but uses both self-report and performance measures to assess EI; the third stream is the mixed model which introduces dimensions that are additional to the original definition of the EI construct and uses self-report measures. A significant amount of research has gone into comparing the performance and self-report measures of EI. Performance measures assess the actual ability, do not overlap with personality, and correlate with cognitive intelligence. EI is seen as a type of intelligence [35]. However, EI, as assessed by self-report measures, did not statistically correlate with traditional forms of intelligence. Performance tests are the gold standards as they measure the actual ability to perform a mental task and not just one's self-efficacy about mental tasks [36,37]. Hence it is evident that EI should be seen as an ability and should be measured by performance measures [25].

Grubb [38] found that all non-cognitive tests can be faked and hence to reduce the level of faking by the respondents, situational judgment tests (SJTs) can be used. SJTs are tests that have items that describe a situation followed by a set of responses. Respondents have to choose the best response to that situation, based on their judgment. They can be used to measure constructs like cognitive ability, personality, age, etc., [39]. Sharma and colleagues [26] found potential benefits in using SJTs to measure EI. Situational judgment tests put the respondents in a simulated stimulus and make them select the response. Since the aim of an EI test is to infer how a person is likely to behave in a particular situation, the usage of SJTs to assess EI is justified. Lievens and Chan [40] explain that SJTs are realistic ways of measuring EI and its application, compared to self-report and performance-based measures. The review shows that situational judgment tests are appropriate to measure EI.

The first step in the development of an instrument to measure a construct is to clearly understand and define the construct [41]. Given the lack of agreement among researchers about what constitutes EI, the essential first step is to conceptualize EI appropriately. Mayer and Salovey [1] made it clear that EI is related to the generation and regulation of emotions. Using this conceptualization as the basis, the study aims to develop and validate an emotional intelligence test comprising of SJTs to assess the EI levels of medical students.

3. METHODOLOGY AND RESULTS

The study protocol was approved by the Institutional Human Ethics Committee and was executed at a private medical college in South India in the following four phases:

Phase1: Formulation of Situations for SJTs.
Phase 2: Development of the EI Test.
Phase 3: Pilot study and Purification of Test.
Phase 4: Assessing the predictive validity of the EI Test.

3.1 Phase 1: Formulation of Situations for SJTs

During the first phase, the authors attempted to understand the emotional challenges faced by the medical students, which would in turn serve as the basis for creating items for the SJTs. A questionnaire was developed to collect data about the challenges faced by medical students. The questionnaire requested the students to describe the situations in which they were emotionally disturbed, how they felt, and how they coped with the situation. The study included 55 respondents who were pursuing their Bachelor of Medicine, Bachelor of Surgery (MBBS in India) course at the medical school with the following demographics (Table 1).

The students were informed well in advance and were requested to assemble in a classroom where a briefing was done on the study by the researchers. Informed consent was obtained and the students were asked to fill the questionnaire. After all the students completed the questionnaire, the researchers initiated focus group discussions in groups of 10 students. The participants were asked to discuss the issues related to the objective of the study.

Table 1. Details of the sample for phase 1

Year of Study	N	Hostellers	Day Scholars	Male	Female
I	14	11	3	8	6
II	12	8	4	3	9
III	15	13	2	6	9
IV	14	12	2	3	11
Total	**55**	**44**	**11**	**20**	**35**

Table 2. Components in the emotional intelligence test – before validation

EI Constituent	Number of Items
Perception	5
Appraisal	18
Regulation	15

The data provided by the students was transferred verbatim into electronic form. There were 126 situations, out of which 122 could be fit into different themes. From the 126 situations, 33 situations that could serve as test items were selected [42]. The samples are provided in Appendix 1.

The data collected in response to the question on how they responded to those challenges served as the basis to create multiple responses for each situation. The responses of students to the challenges were analyzed by a team consisting of 4 psychologists to construct four different responses for each of the 33 situations [42].

3.2 Phase 2: Development of the EI Test

The second phase of the study pertained to the design and validation of the Emotional Intelligence test for medical students. The test aimed to assess the ability of respondents to perceive (ability to understand own and other feelings), appraise and regulate emotions (ability to read the atmosphere and use this to guide their behavior).

The items in the perception subscale were designed to assess the ability of individuals to identify the basic emotions in faces. To assess perception, the 5 items from the previous scale designed by Krishnaveni and Ranganath [22] were retained. The researchers used Situational Judgment Tests (SJTs) created from the situations generated in phase I to assess the appraisal and regulation abilities. The components of the initial test to measure EI are indicated in Table 2.

The items were reviewed by three subject experts for establishing content validity. All the 33 items were rated as 'relevant' or 'not relevant' by the three experts. The experts also suggested changes for a few items to make them relevant. The Fleiss' Kappa was calculated based on the Item Content Validity Index (I-CVI), which yielded a value of 0.7, which is good [43]. The changes suggested by the experts were incorporated in the test items. The experts also scored the items and selected the first best and the second-best response. The first best response was awarded 5 points, the second-best response was awarded 3 and the rest of the responses were awarded 1point. Sample items from the questionnaire are presented in Appendix 1.

3.3 Phase 3: Pilot Study and Purification of Test

The finalized questionnaire was administered to a sample of 150 students, selected by simple random sampling from the II, III, and IV years of the MBBS course. After obtaining written informed consent from the students, they were asked to fill the questionnaire. The data obtained from the pilot study were consolidated and subjected to reliability tests as indicated in Fig. 1.

To test the reliability of instruments, they have to be purified. It is an iterative procedure by which the items that weaken the internal consistency of the construct are removed. Internal consistency is the extent to which the items contributing to the construct being measured are inter-correlated [44-46].It is checked by examining the corrected-item total correlation (CITC) of each item with a specific dimension of a construct. Clark and Watson [41] recommend that the average inter-item correlation can fall in the range of 0.15 to 0.50. The normal procedure is to delete items with CITC values below 0.4.

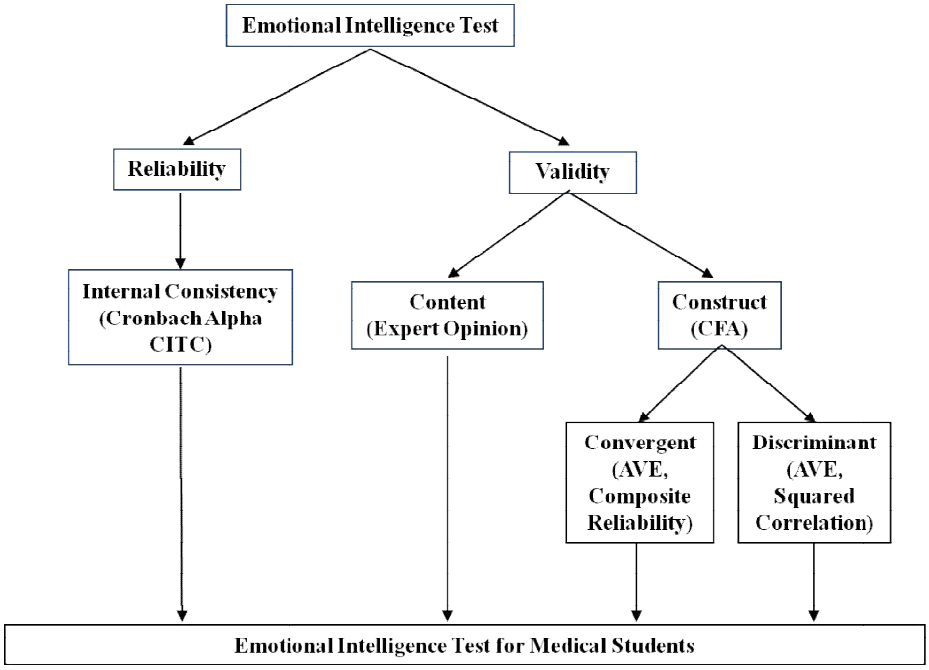

Fig. 1. Process for establishing reliability and validity
Source: [Krishnaveni and Ranganath (2011, pg. 102)]
(CITC = Corrected Item Total Correlation; CFA = Confirmatory Factor Analysis; AVE = Average Variance Extracted)

Table 3. Corrected item total correlations of items in the purified scale

Indicator	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
a5a	.25	.77
a5b	.44	.75
a6a	.45	.75
a6b	.30	.77
a7b	.45	.75
a8a	.40	.76
r2	.36	.76
r3	.46	.75
r7	.40	.76
r10	.51	.74
r11	.44	.75
r12	.48	.75

However, sometimes items with CITC values less than 0.4 can be retained and certain items with CITC greater than 0.4 can be removed. This is decided based on the "alpha if deleted" value to improve the internal consistency reliability of the construct. With these guidelines about alpha and CITC as the basis, the initial scale was purified.

Most of the responses to the perception dimension were found to be similar with no variance. Thus they convey limited information, correlate weakly with other items, and will also fare poorly in subsequent analysis. A discussion with experts (psychiatrists and clinical psychologists) revealed that the perception component would be accounted for when the respondents analyze the situations given in the other constructs. Thus, during the purification process, the 5 items contributing to the construct of perception were dropped. The appraisal construct had 6 items and the regulation construct had 6 items. After many iterations, the purified scale was arrived at. The purified scale

had six items each to assess appraisal and regulation. In all, it had 12 items.

The reliability of the appraisal and regulation constructs were 0.62 and 0.69 respectively. The overall reliability of the purified scale was 0.77. The corrected item-total correlation values are presented in Table 3. The purified scale was then subject to construct validity tests. In social sciences, there is a disagreement on what constitutes an adequate demonstration of validity [47]. Previous studies [47-49] have argued that to demonstrate the validity of a latent variable (a latent variable is one whose value cannot be measured directly but by using observed variables), the content or face validity of its indicators, the construct validity of the latent variable, and its convergent and discriminant validity must be established.

To demonstrate the construct validity, Partial Least Squares (PLS) software was used. PLS combines features from principal component analysis and multiple regressions. The factor analysis was carried out to examine the factor loading and cross-loadings. The results in Table 4 show that the factor loadings are appropriate. The model fit was also ascertained using the t-statistics. The items a6a and r2 had equal loadings on both constructs and had a t-statistic of 1.86 and 1.88. However, based on the underlying theoretical aspects behind the constructs, a6a was retained as an item in the appraisal construct and r2 in the regulation construct.

According to Fornell and Larcker [50], convergent and discriminant validity can be examined to establish construct validity. The average variance extracted (AVE) values are used to assess convergent validity. The AVE is an indicator of the amount of variance captured by the construct in relation to the amount of variance due to measurement error. An AVE of 0.5 or above demonstrates convergent validity. The composite reliability of the construct should be greater than 0.7 [51-53]. Composite reliability is the total amount of true score variance relative to the total scale score variance. It was found that the appraisal construct had an AVE of 0.35 and composite reliability of 0.75; the regulation construct had an AVE of 0.41 and composite reliability of 0.8, thus proving convergent validity. Though the required value of AVE is 0.5, as the dimensionality of the construct was ensured, it can be justified that the instrument demonstrates convergent validity.

Fornell and Larcker [50] had also stated that average variance extracted can be used to establish discriminant validity. They opined that when the squared correlation between two LV's is less than either of their individual AVE's, it indicates that the LV's each have more internal variance than variance shared between the LV's. If this condition is true for the target LV and the other LVs, the discriminant validity of the target LV is established [54]. The squared correlation between appraisal and regulation is 0.23, which is less than the AVE of the constructs appraisal (0.35) and regulation (0.42). Thus the condition for discriminant validity is also satisfied. This type of discriminant validity ensures that the two constructs' appraisal and regulation are distinct from each other and they measure different sets of abilities. Thus the validated scale had 12 items to measure emotional intelligence.

Table 4. Matrix of loadings and cross-loadings

Scale Items	Appraisal	Regulation
a5a	**0.42**	0.22
a5b	**0.79**	0.27
a6a	**0.40**	0.44
a6b	**0.38**	0.26
a7b	**0.71**	0.37
a8a	**0.72**	0.26
r2	0.36	**0.37**
r3	0.35	**0.64**
r7	0.21	**0.69**
r10	0.32	**0.76**
r11	0.29	**0.69**
r12	0.38	**0.65**

3.4 Phase 4: Assessing the Predictive Validity of the EI Test

The fourth phase focused on assessing the predictive validity of the EI test. The sample for this phase consisted of all Year II students of the MBBS course in a private medical college in South India. There were 150 students out of which, only 130 participated. The validated test was administered on these students. Among these responses, only 102 (34 males and 68 females) were validated responses. The emotional intelligence was measured by the validated scale and there was a ten-month gap between phases 3 and 4. The academic scores of these 102 students were obtained from the college authorities. The marks scored by each student in four subjects of that semester (microbiology, forensic medicine, pharmacology, and pathology) were averaged. This average score was taken as the academic performance score for analysis. The correlation between the EI scores and academic performance scores was analyzed. EI score correlated significantly with academic performance ($r = 0.29$; $P < .01$). Both constructs appraisal ($r = 0.25$; $P < .01$) and regulation ($r = 0.24$; $P < .01$) correlated significantly with academic performance. These findings indicate the predictive ability of the EI measure. The purified scale used in the fourth phase yielded a reliability of 0.6, which is at an acceptable level [55]. Hence the scale has demonstrated test-retest reliability.

4. DISCUSSION

This study addresses the development and validation of an SJT-based measure of EI. Grubb [38] found a significant correlation between EI measured using Bar-On EQi (a test to measure EI developed by Reuven Bar-On) and Self-report measures and EI measured using situational judgment tests. Ciarrochi and Mayer [56] suggested that situational factors are the way forward to assess and increase emotionally intelligent behavior. Based on this, the present study developed a situational judgment test-based instrument to measure EI.

Emotions are context-bound [57,58] and hence the authors derived the situations for the SJTs from an initial study that analyzed the emotional landscape of the medical students [42]. Hence the items in the EI test were appropriate to the context of medical students. The study has also established that the test for EI with two factors is reliable and valid. Both the factors of EI, namely, appraisal and regulation, significantly correlated with academic performance, and hence the EI measure has predictive validity.

The EI test was developed to assess the EI levels of medical students in India. Lievens and Sackett [59] have opined that situational judgment tests developed in one particular culture and context cannot be used in other contexts and cultures. Sharma and colleagues [26] have expressed that ‘some situations and responses that are very relevant in India, might not be relevant in western cultures‘ (pg 66). Hence the future scope of research would be to validate this test in other cultures and generalize the same.

5. CONCLUSION

This study is a first step towards the development of an emotional intelligence test for medical students. It has immense scope for further research in terms of developing a pan-cultural and valid SJT-based measure for EI. The construct validity was established using Fornell and Larcker's criterion. However, the future scope would be to establish convergent validity and discriminant validity with appropriate external tools/tests. A review of the literature showed a dearth of tools to assess the EI of medical students. There are many EI tests and an appropriate one could be used to establish the convergent validity of the tool developed by this study. The study can be repeated on a larger sample size to establish predictive validity. The study also showed that the emotional intelligence of medical students could predict their academic achievement. Hence medical schools should include EI assessments and development as part of the curriculum. The instrument developed by this study would provide a premise for the assessment and development of training programs. The enhancement of curriculum with EI training will yield medical professionals who also display empathy, great character, integrity, maturity, and effective communication. Emotional intelligence is said to have an impact on ethical judgment [60]. Ethics is an important aspect of the medical profession and hence EI training will help professionals to make ethical decisions. Such professionals will deliver enhanced patient-centered care in the healthcare industry.

CONSENT

All authors declare that ‘written informed consent was obtained from the respondents for

publication of this research paper. A copy of the written consent is available for review by the Editorial office/Chief Editor/Editorial Board members of this journal.

ETHICAL APPROVAL

ALL authors hereby declare that THE STUDY PROPOSAL HAD been examined and approved by the Institutional Human Ethics Committee of the private medical college in which the study was conducted.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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APPENDIX

Appraisal: Sample Item

One of your classmates is doing a case presentation to a senior consultant in your ward posting. During the presentation, the consultant shouts at your classmate for a mistake he made in the case presentation. There are patients and nurses around when this happens. How will you feel?

a. Angry
b. Proud
c. Sad
d. Hatred
e. No feeling
f. Other

Regulation: Sample Item

You are on your usual ward visits. You are attending to a patient Mr. Kumar who has been previously treated for cancer. As you are going through his preliminary investigations, you find that there is a higher possibility of recurrence. When you are about to leave, Mr. Kumar asks you "Doctor, please tell me honestly. Is my cancer back?" What will be the most appropriate response to Mr. Kumar?

i. Tell Mr. Kumar that you need to look into further tests before you get back on this.
ii. Respond to Mr. Kumar by saying he will be fine.
iii. Pretend as though you have not heard him and speak about something else.
iv. Tell Mr. Kumar that there is a high possibility of recurrence.
v. Other.

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