Medical Student Education

Identifying the Attributes of Instructional Quality in Ambulatory Teaching Sites: A Validation Study of the MedEd IQ©

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Background: *Instructional quality in ambulatory settings may vary. The MedEd IQ© is an instrument that measures unique aspects of the clinical instructional process. This study assesses the construct and factorial validity of the MedEd IQ.* Methods: *First-year students (n=764) in Introduction to Clinical Medicine courses and third-year students (n=711) in family medicine clerkships evaluated 249 clinical teaching sites affiliated with two medical schools, using MedEd IQ questionnaires at the conclusion of clinical training (1996–2000). Factor structures were identified and relationally defined through exploratory and confirmatory factor analytic techniques, and a measurement model for assessing instructional quality was refined.* Results: *Four unique factors were identified that contribute to instructional quality: preceptor activities, learning environment, learner involvement, and learning opportunities. Of 33 items within the instrument, 22 were retained in the final structural model. Two indices of fit, a comparative fit index of .935, and a root mean square error of approximation of .063 indicated close agreement between the defined model and the observed relationships between items.* Conclusions: *The MedEd IQ measures four factors important to ambulatory medical education and provides a basis for a new measurement approach to assessing instructional quality.*

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Despite academic medicine's growth in size and stature in the 20th century, questions remain about the quality of clinical training for medical students.[1] Social and economic pressures have distanced education from the central mission of academic health centers,[2] leading to greater reliance on community-based ambulatory teaching sites. Educating students in these sites presents unique challenges. Physicians in these sites are committed to full clinical schedules with productivity goals separate from teaching responsibilities, and course directors are unable to oversee these training sites. Despite these challenges, medical schools increasingly rely on volunteer faculty at distant sites to help achieve the social goal of producing a generalist physician workforce.[3,4]

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Concerns about the quality of community-based education have been expressed, and a call has been issued to assess the quality of medical education, particularly in remote clinical teaching sites.[5] Valid and reliable measures are needed to address the unique challenges in this training environment. Yet, defining and measuring components of medical education have been limited by the lack of an effective research model and an evaluation strategy.[6]

Previous research in community-based medical education has identified components important to instructional quality.[7,8] Using these components, we developed the MedEd IQ,© a student assessment of instructional quality. Based on qualitative observations of teaching and learning in clinical settings,[8,9] the MedEd IQ uses experiential learning theory to understand the process of instruction.[10] Additionally, it embraces quality improvement theory as the basis for an assessment strategy.[11]

The MedEd IQ has previously been studied for its predictive validity,[12] reliability, and generalizability.[13] This study examines the construct validity of the MedEd

IQ with respect to its factor structure and the implications for measurement of instructional quality in ambulatory medical education.

Methods

The 33-item questionnaire is comprised of four sections, with responses scored on a 5-point scale from strongly disagree to strongly agree. Data from three sections represented ratings on three subscales used to assess site-specific quality. The fourth section contained students' ratings of the preceptor at the site. Examples of MedEd IQ items are shown in Table 1 and Figure 1.

Instruments

The MedEd IQ appraises instructional quality as a process consisting of four attributes. These include (1) a learner involved in the clinical/education process, (2) a teacher/physician who manages teachable moments, (3) an environment that is conducive to instruction, and 4) an environment that provides learning opportunities for the learner to experience, reflect on, and assimilate.[7,8]

Data Collection

During 1996–2000, 1,872 first- and third-year medical students returned 1,475 forms (764 first year and 711 third year) from 249 clinical sites, rating each site an average of 5.9 times, for a response rate of 78.8%. In addition, more than 347 preceptors were rated an average of 4.9 times, with some students completing evaluation forms for more than one preceptor while studying at a particular site.

The students in the study were involved in courses that were selected because they used office-based instruction at two different stages in the medical education process. One course was the third-year family medicine clerkship, for which the clinical sites were predominantly staffed by volunteer family practice offices, though some sites were residency training sites affiliated with community hospitals. The other course was the first-year introduction to clinical medicine course, for which sites were more likely primary care or specialty clinics affiliated with academic health centers, though some students were in family practice offices.

Students completed the MedEd IQ at the conclusion of their clinical experience, usually the last day of the course. Informed consent was obtained; students' signatures were on a separate page. The questionnaire contained only a unique identifier to maintain confidentiality. To enhance confidentiality and reduce score variance, no feedback was provided to clinical sites or preceptors until at least four evaluations were done. The MedEd IQ evaluation in no way influenced students' grades for the course.

Students indicated their primary preceptor on the site evaluation form, and their evaluation of this preceptor was merged with their site ratings for use in this analysis. Forms with missing data were deleted, yielding a total of 938 (367 first year and 571 third year) observations for entry into the factor analyses.

Table 1

Varimax Factor Loadings

Factors (in bold) *Items on MedEd IQ©* (item # in italics)*		*Factor Loading***
Preceptor Activities: My clinician teacher . . . (α=.90)†		
I-1	Failed to prepare me for patient encounters	.56614
I-2	Gave me specific information that helped me improve my skills	.75967
I-3	Wasn't interested in listening to me	.49164
I-4	Was able to talk to me at any level of expertise	.54349
I-5	Pointed out things I hadn't previously seen in a way that allowed me to learn from these oversights	.71601
I-6	Made every patient encounter a learning experience	.75574
I-7	Improved my understanding of clinical practice (such as physical exams, medical decision making, treatment options, etc)	.68970
I-8	Criticized me without offering suggestions for improvement	.43387
I-9	Helped me to address conflict arising from when patient preferences were different from my own	.49764
I-10	Developed increased understanding of my knowledge and skills over time	.71839
I-11	Did not adequately supervise me	.59823
Learning Environment: (α=.75)†		
I-12	Things were moving too fast for me to really learn anything	.53380
I-13	The site was set up so I could easily join in patient care	.50225
I-14	I felt like my time was "wasted" due to the way things were run	.62799
Learning Opportunities: (α=.85)†		
I-15	I had the opportunity to practice and improve my communication skills	.56599
I-16	I had the opportunity to increase my independence in providing patient care	.75162
I-17	I felt like an active participant in all aspects of clinical practice, from history taking and physical exams to decision making and patient education	.62826
Learning Involvement: How would you characterize your participation and level of decision making with . . . (α=.87)†		
I-18	Laboratory tests	.67111
I-19	Use of radiology	.49030
I-20	Pathophysiology	.60231
I-21	Decision making with diagnosis	.82027
I-22	Treatment options	.84931

* Items scored on 5-point scale (strongly disagree to strongly agree) except Learning Involvement had a 3-point scale ("no participation," "minimal participation," and "good deal of participation")

** Factor loadings >.4 are retained with each construct.

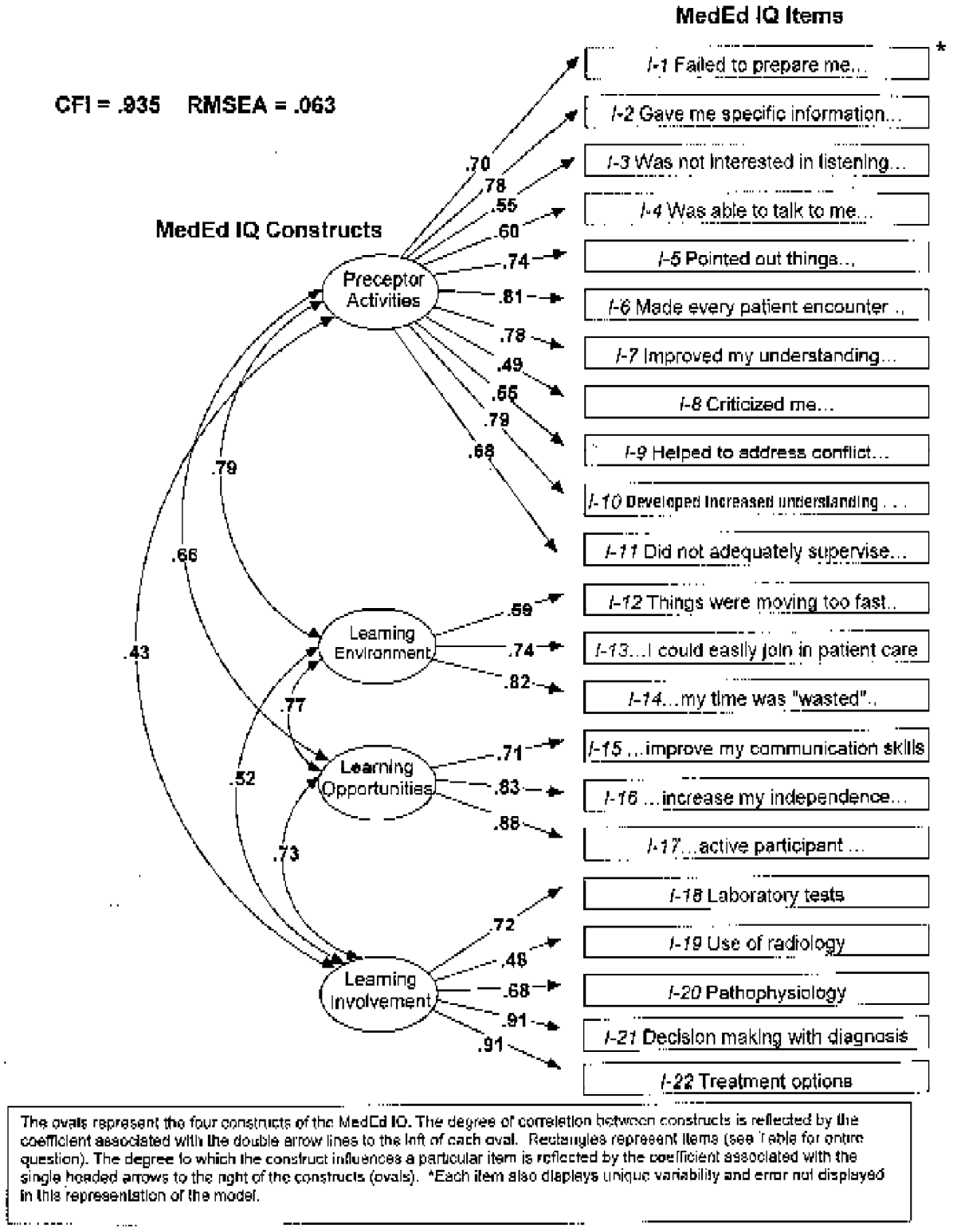
† Alpha scale reliabilities are listed in parentheses.

Data Analysis

Principal axis factor analysis was applied to the 33-item correlation matrix; squared multiple correlations

Figure 1

Instructional Quality Confirmatory Factor Model



The ovals represent the four constructs of the MedEd IQ. The degree of correlation between constructs is reflected by the coefficient associated with the double arrow lines to the left of each oval. Rectangles represent items (see Table for entire question). The degree to which the construct influences a particular item is reflected by the coefficient associated with the single headed arrows to the right of the constructs (ovals). *Each item also displays unique variability and error not displayed in this representation of the model.

CFI—comparative fit index
RMSEA—root mean square error of approximation

represented the communalities on the main diagonal. An examination of the magnitude of the eigenvalues, using Kaiser's eigenvalue rule[14] and scree plotting,[15] determined the number of factors extracted. A factor analysis with a varimax rotation was used to generate factor loadings for the number of factors indicated. Individual items were evaluated and included or excluded into the confirmatory structural factor model based on the magnitude of the factor loading, a demonstration of simple structure, and the interpretability of the factor. Each retained item was assigned to a single factor based on its highest loading. The fit of the model was evaluated using both the comparative fit index (CFI)[16] and the root mean square error of approximation (RMSEA).[17] All factor analytic procedures were conducted using SAS® and AMOS® software.

The analyses were designed to first provide information regarding how each item or question performed in the measurement of its intended dimension of instructional quality. Specifically, the exploratory factor analysis was used to inform decisions regarding how items would be used to derive subscale scores. Based on this information, items could be reassigned to a different construct, deleted, or retained to measure the intended construct. A model describing the overall functioning of the instrument could then be constructed based on both empirical and content validity. The subsequent confirmatory factor analysis allowed an objective assessment of how well the constructed model agreed with the observed relationships between the items.

Results

Exploratory Factor Analyses

Five factors with eigenvalues greater than one were initially extracted using the principal axis method. With the fifth-factor eigenvalue equal to only 1.03, and a scree analysis suggesting eigenfactors 5 through 33 to be trivial, four factors were retained for confirmatory factor analysis modeling. These factors reflect the preceptor activities, learning environment, learning opportunities, and learner involvement subscales and were dimensions consistent with item content. Loadings from the varimax rotation on the primary factor are shown in Table 1 for the 22 items retained. The decision to retain items was based on the criteria of having a single factor loading greater than .40 and interpretability. As shown in Table 1, the first factor to emerge, with all items correlated in the positive direction, was the preceptor activity construct. The second and third constructs, learning environment and learning opportunities, each emerged with only three items positively correlated. The last construct, learner involvement, displayed five items loading predominantly on this factor. The four factors displayed are congruent with the domains previously published.[8] Values in parentheses listed in Table 1 are coefficient alpha scale reliabilities.

Confirmatory Factor Analyses

For the confirmatory factor analysis, a model was constructed using the 22 retained items and four factors from Table 1. As shown in Figure 1, each item in the model was an indicator of a single factor or construct, consistent with the theoretical design and previous research on the instrument. The correlated factors, the correlation among items and factors, and the path arrows defining relationships in the model are represented.

The four factors/constructs are represented by the ovals with the level of correlation between constructs reflected by the coefficient associated with the double arrow lines. Items (questions found in Table 1) are represented by rectangles. The degree to which the construct influences a particular item is reflected by the coefficient associated with the single-headed arrows emanating from the constructs. Each item also is associated with unique variability and error not displayed in this representation of the model.

Item variance not shared with any factor is a combination of unique item variance and error but is not represented in Figure 1. A CFI measure of .935 exceeded the .90 criteria level used to indicate close fit.[16] An obtained RMSEA measure of .063 (with 90% confidence interval of .059–.067) also indicated a good fit for the model as defined.[17]

Discussion

We have identified and empirically validated four measurable constructs vital to assessing instructional quality in ambulatory settings. These constructs, initially identified from qualitative studies,[8,9] have been strongly supported using a confirmatory factor analysis. This study provides important evidence regarding the factorial validity of the MedEd IQ and will further inform refinement of the instrument.

In the first subscale, preceptor activities, students rate how the preceptor functions as a teacher. The items measure traditional notions of teaching effectiveness,[18] as well as other "managerial" activities important to instruction. Items loading on this construct emphasize that students value open communication with the teacher, various forms of feedback are ongoing processes, and learning and learners are valued entities. This construct correlates highly with the learning environment scale, suggesting that the interplay among learners, patients, and the clinical setting is associated with activities of the teacher that may not be related directly to teaching.

The second subscale, learning environment, assesses student ratings of the clinical office and how it functions, with patients as a primary care classroom. The critical aspects of this construct include establishing an environment where the learner is integrated into the clinical setting, establishing a pace for clinical contact

that allows meaningful learning opportunities, and enabling patients to become partners in instruction.

The learner involvement subscale assesses student involvement in meaningful clinical activities and strongly correlates with the learning environment and learning opportunities subscales. We believe that this may represent the willingness of patients in the learning environment to allow students to participate in their care, producing experiences that translate into learning opportunities. The ability and initiative of the learner to participate in meaningful clinical activities is vital to quality instruction.

The learning opportunities subscale represents the ability of the site and teacher to craft real-life experiences that allow the learner to grow through experience, reflection, and assimilation. Practicing skills, growing in independence, and integration as a member of the health care team are the important components of this factor. This construct is more strongly correlated with the other three constructs, suggesting the important influence of (1) a teacher who positions the student in appropriate situations, (2) a learner involved in meaningful clinical experiences, and (3) an environment with patients responsive to the learning needs of students.

The resulting model that emerged from the confirmatory factor analysis contains only 22 items but is consistent with the intended interpretation of the subscales and appears to fit closely with the observed data. The 11 deleted items loaded on more than one factor, presented interpretative complications, or displayed weak association with any single factor. Two subscales contained only three retained items. To achieve a minimum of five items per scale as indicated by a previous investigation,[13] future instrument development will focus on generating additional items that reflect the latent constructs represented by these factors.

Limitations

While our sample was large and included the evaluations of students in the first and third years of training in two different medical schools, the factorial validity of this instrument should be further examined under a wider range of measurement situations. Cross-validation measures from other geographical locations within a wider range of clerkships would provide useful information regarding factor stability. The MedEd IQ is a learner assessment of instructional quality. As such, it is subject to concerns of potential bias toward preceptors who may be socially responsive to the students, yet poor instructors. While we cannot rule out this bias, the major purpose of this study was to examine different constructs through learner assessment. Student assessments were completed prior to receiving grades for the courses, and their responses were guaranteed to be confidential. Ultimately, we feel that there is no better source for the assessment of instruction than the student.

Conclusions

It is time to assess community practices, provide purposeful feedback, and commit to improving the quality of medical education. The MedEd IQ is a valid and useful instrument whose purpose is to monitor and compare instructional quality in ambulatory-based clinical instruction. It has been tested for reliability using generalizability analysis and has demonstrated factorial validity consistent with its underlying theory using a confirmatory factor analysis.

The MedEd IQ can provide data that will (1) facilitate systematic comparison of different clinical teaching sites, (2) direct faculty development resources toward improving instructional quality, (3) enable course directors to reduce reliance on low-scoring training sites, and (4) evaluate the impact of changing educational policy. The use of the instrument as a tool in the accreditation process to evaluate instructional quality within community sites is an important area for further research. Until now, the limiting factor for addressing the issue of quality instruction in community settings has been the lack of a valid and reliable assessment method. We believe that this instrument and a consistent evaluation strategy will allow comparative assessments to benchmark and monitor instruction in community-based sites.

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