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Validation of the Teacher Identity for Medical Faculty Members Scale (Short Version)

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Abstract

Background & Objective: Quality of the provided educational services to medical students is one of the main concerns of the authorities of the medical education system. Currently, there are theoretical and methodological ambiguities regarding the definition, conceptualization, and determining the factors involved in the concept of the teacher identity in physicians. Most of these challenges are due to the lack of proper, time-consuming measurement tools. Developing valid and reliable measurement tools is an important step toward effective medical education. The present study aimed to develop and validate the teacher identity for medical faculty members scale (short version).

Materials and Methods: This descriptive, correlational study was conducted on 156 professors of medical universities, who were selected via multistage cluster sampling. Heuristic, validation, and confirmatory analyses were performed using the method of partial least squares, including the evaluation of measurement models (Cronbach's alpha, factor loading coefficients, composite reliability, convergent and divergent validity), fitness of the structural model (significance of path coefficients, coefficients of determination, model prediction, goodness of fit index).

Results: The final tool had 20 items in four dimensions of educational domain, teaching and learning, perceptions toward medical education, and professional development. The results of heuristic and confirmatory analyses indicated the appropriateness and acceptability of the underlying structure of the indices and factors.

Conclusion: According to the results, the teacher identity for medical faculty members scale (short version) has proper construct validity and reliability to be used for the assessment and identification of the strengths and weaknesses of teacher identity in physicians and develop medical education.

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Introduction

The main duty of medical schools and universities is the training of the workforce required for the promotion of health care in the community. Development of continuous educational curricula in line with the educational needs of the target group has been prioritized in the implementation of educational programs, as emphasized by the medical community (1). All medical professors are committed to their method of educating human workforce; the important issue is that professors contemplate their own experience and focus on the learning of students, so that if they are given another chance for teaching, they would attempt to come up with the best techniques to improve the quality of their courses and perform differently (2). Therefore, the mission of medical education is to train capable and competent workforce who have the required knowledge, perception, and skills for the promotion of community health (3).

The increasing complexities in healthcare settings urge physicians, who are the primary members of the healthcare team, to acquire a professional identity, which depends on the capabilities and professional identity of medical educators (4, 5). Evidently, if medical educators have the required professional identity for the teaching of students, they will be able to play a key role in educating efficient physicians for optimal treatment and care (5, 6). Therefore, the teaching identity of physicians is the personal and collective perception of medical professors toward themselves as a medical educator in the society. In other words, the teaching identity of physicians is formed personally, which denotes their personal perspective, and generally, which denotes the collective perspective in this regard (7). Ahir et al. define validation as the evaluation of a task, process or tool for decision-making regarding its appropriateness. As such, the main goal of validation is to codify definite documents and evidence for decision-making about the predetermined quality and features of a task, process, program or tool (8).

Medical education is based on the training of students by physicians, residents, and medical personnel. As specialists, physicians are trained on the presentation of medical care, while they receive less training on teaching (9). Therefore, it is essential that medical schools provide faculty members with the curriculum on the education and development of knowledge, skills, and perceptions toward

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teaching in order to enhance teacher identity (10). Medical schools are constantly seeking methods to increase the recruitment of primary care physicians. Recruitment and employment of physicians who are willing to teach is remarkably difficult for medical schools (11). Meanwhile, teaching and participation in educational activities increases the pleasure of patient care (12), improves clinical skills and specialty, and increases job satisfaction and the joy of teaching (14). In the studies by Bijard, Major, and Verloop, the findings indicated that most of the research in the literature has been focused on the knowledge, perception, and skills of teachers, and few studies have investigated teacher identity (15). Furthermore, in the study by Chong, the results showed that most of the studies regarding the professional identity of teachers have been qualitative, and there are limited quantitative studies in the literature (16). Therefore, researchers who are interested in the professional identity of nurses (17-20), teachers (15, 21-24), faculty members (25-28), and physicians (29, 30) have extensively assessed these issues in qualitative studies, and the number of the quantitative studies have declined. Validation of the measurement tools for the teaching identity of physicians has been performed in the studies by Star et al. in the United States (30) and Chong, who assessed the professional identity of teachers in Hong Kong (16). In Iran, Tabatabaei, Motaharinejad, and Tirgar have validated the measurement tool for the teaching identity of physicians (10). With this background in mind, we have attempted to develop and validate the short version of a scale for the assessment of the teaching identity of medical faculty members.

The perceptions of faculty members toward their teaching identity could help medical schools with the recruitment, employment, and support of instructors through providing information (10). Moreover, medical schools will be able to use this scale in order to determine the strengths and weaknesses of professors, so that all the faculty members, instructors, and authorities of the medical education system would be evaluated. The scale developed in our study could be a viable measurement tool in Iran considering features such as concision, originality, and relevance to the research theory.

The present study aimed to determine the underlying factors of the reliability and validity of the short version of the teacher identity for medical faculty members for the validation of the instrument.

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Materials and Methods

This was an applied research in terms of objective and descriptive (non-experimental) in terms of the data collection method. Specifically, this study was based on factor analysis and modeling of structural equations using partial least squares (PLS).

The sample population of the study included all the faculty members of medical sciences, who were selected via multistage cluster sampling. Among 48 medical schools affiliated to the universities of medical sciences across the country, 14 schools were selected randomly (Table 1). To do so, the emails of the faculty members at the selected medical schools were obtained from the websites of the schools. Afterwards, an electronic questionnaire was sent via email to the faculty members (general and academic) via Google Doc in two stages. The first stage was preliminary, and the second stage was a reminder after three weeks. In total, 156 faculty members were selected as the participants. Participation in completing the electronic questionnaire was voluntary, and the participants consented to perform this stage. To observe ethical considerations, the information of the participants remained confidential. It is notable that there were two main criteria for determining the sample size based on PLS (31), which was ten times the maximum number of the measurement model indices and ten times the highest correlations within the structural variables (10). Correspondingly, the minimumsample size for the first and second criterion was estimated at 50 and 60, respectively, which assured the adequacy of the sample size in PLS.

Table 1: Participation rate of statistical society of research

University	Email sent	Email Accountability	University	Email sent	Email Accountability	University	Email sent	Email Accountability
Arak	257	4	Tehran	347	15	Golestan	189	13
Orumieh	321	13	Shahid Beheshti	310	21	Gonabad	85	5
Esfahan	336	14	ShahreKord	155	5	Qazvin	221	10
Ilam	116	9	Shiraz	320	11	Yazd	269	8
Tabriz	360	9	Kerman	238	19			

The questionnaire used in the study consisted of 37 items regarding the teacher identity of medical faculty members (10), which was reduced to a shorter version with 20 items. The short version of the teacher identity scale for medical faculty members included four

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main dimensions educational domain, teaching and learning, attitude toward medical education, and professional development. The items in the questionnaire were scored based on a five-point Likert scale (Totally Agree: 5, Totally Disagree: 1) with the maximum and minimum scores of 100 and 20 for the items, respectively.

In a qualitative study, Star et al. conducted interviews with 35 professors to extract the components of teacher identity (7). In a quantitative research, a pilot was performed to assess the teacher identity in the University of Massachusetts in the United States (30). In the study by Star et al., the reliability of the questionnaire wasconfirmed at the Cronbach's alpha of 0.95 and 0.92 using retest (30). In Iran, Tabatabaei, Motaharinejad, and Tirgar validated the research instrument at the Cronbach's alpha of 0.91, while the composite reliability was estimated at 0.92 (10). In the present study, the reliability of the questionnaire was confirmed at the Cronbach's alpha of 0.89, and the composite reliability was calculated to be 0.90. Since the short version of the questionnaire in our research was extracted from the main instrument, we needed to rename the factors and validate it. To this end, the validity and renamed factors were approved by two faculty members of educational sciences.

Heuristic factor analysis, which mainly emphasizes on statistics rather than theory and inability to measure errors, is subject to criticism (32); consequently, confirmatory factor analysis was used for the validation of the instrument as well (33).

The fitting of the general model was controlled based on the goodness of fit (GOF), which have been developed by Tenenhaus, M., Amato S, & Esposite Vinzi, V. According to these researchers, this criterion is a practical solution for the assessment of the general fitness of the model and could be used for evaluating the overall validity and quality of the model. Moreover, it could assess the prediction ability of the general model, indicating whether it has been able to predict the hidden endogenous variables (10). Based on the following formula, the three values of 0.01, 0.25, and 0.36 were considered as low, medium, and high, and high fitting was observed in the current research (0.56).

$$\text{Goodness of Fit Index}=\sqrt{\text{convergentvalidity} \times \text{determination coefficient}}=\sqrt{0.55 \times 0.59}=0.56$$

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Results

In terms of the demographic characteristics, among 156 participants, 99 (63.9%) were male, and 56 (36.1%) were female. Regarding the academic status, 29 (18.7%) were instructors, 72 (46.5%) were assistant professors, 38 (24.5%) were associate professors, and 16 (10.3%) were professors. With respect to employment, 8 (5.2%) were visitors, 55 (35.5%) were contractual, and 92 (59.4%) were officially employed.

To determine the underlying factors of the short version of the teacher identity questionnaire for medical faculty members, we used the heuristic factor analysis. The first step for the modification and correction of the instrument was evaluating the correlations between each of the items with the total score of the scale and Cronbach's alpha in the case of removing a specific item (34). Items with the correlation-coefficient of less than 0.30 had to be eliminated at this stage (35). Among 37 items in the questionnaire, items 18, 25, 29, 31, 36, and 37 had low correlations with the entire test and were eliminated. As such, the Cronbach's alpha coefficient increased to 0.91, which is acceptable based on Nunnally's criteria that considers higher Cronbach's alpha values of more than 0.7 acceptable (35).

To assess the sufficiency of the correlation matrix for the heuristic factor analysis, the criteria of Kaiser-Meyer and Bartlett's test was used. In addition, sampling adequacy was estimated at 0.836, which is within the acceptable range and confirms the adequacy of the data for heuristic analysis. Bartlett's test with the X^2 (1364) was considered significant at less than 0.001, which confirms the factor analysis.

According to the Kaiser criteria, there were 10 primary underlying factors, most of which lacked the proper capability. Therefore, Scree plot was used to determine four proper factors, which were extracted for the short version of the scale of teacher identity for medical faculty members.

Factor Structure: The items in the initial factor structure that lacked appropriateness are not shown in Table 2 and have been eliminated for different reasons, as follows:

A) Items without significant load of more than 0.4 in any of the extracted factors; as such, items five, six, and 24 (loads: 0.63, 0.31, and 0.38, respectively) were eliminated. It is expected that each of the items are correlated with the underlying factors of the construct of teacher identity in physicians, and no significant load was observed in the mentioned items.

Items with more than one significant load that

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cannot be correlated with two factors logically and conceptually; as such, items 10, 26, 30, and 34 were eliminated from the factor structure. This was due to the fact that the items with a loading on two factors are either ambiguous or do not address the significance of the item or measure two different variables.

B) One of the main issues in accepting a factor is that more than two items must have a significant loading on the factor. As such, the factors with the loading of less than two items are eliminated, including items 21 and 22 in the present study.

C) Items with insignificant correlations with a factor despite being within the scope of a factor; for instance, item 32 (*I enjoy being recognized as a teacher.*) had no correlations with the other items in the dimension of teaching and learning in terms of the content. In addition, item 28 (*I am a role model for the students who intend to perform primary care activities.*) had no correlation with the other items in the dimension of professional development and could not be considered part of this factor logically. As such, considering their logical and conceptual correlations, items 28 and 32 were also removed from the factor structure.

The mentioned items were eliminated from the factor structure. Finally, the number of the recommended factors for the heuristic factor analysis was reduced from 10 to four factors in the repeated analysis. The factor structure in Table 2 is the final structure extracted from the heuristic factor analysis.

According to the information in Table 2, the factor load of all the items was more than 0.45. The last column in this table also shows the frequencies of each item. The last two rows in the table show the specific amount and explained variances for each factor. The first factor explains the highest level of the analyzed data, followed by factors 2-4.

Is the factor structure obtained from the short version of the teacher identity scale for medical faculty members confirmed?

Considering that the measurement model was reflective (36), we initially assessed the factor structure and factors. To address this question, we used factor analysis.

To evaluate the significance of the path coefficients through re-sampling, construct level changes was used to correct the errors of the sign changes in 500 samples as recommended in the PLS method (37). The results depicted in Figure 1 show the acceptability of the factor structure in the questionnaire.

Table 2: Finalized Factors after Deletion of Deleted Indicator

No	Indicator	Factors				Communalities
		1	2	3	4	
4	I have looked for opportunities to teach.	0/76				0/67
2	I would miss teaching if I stopped doing it.	0/73				0/60
7	Teaching makes my job more rewarding.	0/71				0/55
3	I truly enjoy the role of teacher.	0/56				0/60
23	It's important to contribute to medical education.	0/44		0/29		0/39
1	I see myself as a teacher.		0/71			0/61
14	I feel part of a community of teachers.	0/30	0/65			0/64
9	I feel skilled as a teacher of students and/or residents.		0/63			0/43
11	Students and/or residents regard me as an effective teacher.		0/62			0/45
8	It is important to me to work in a teaching practice.		0/54			0/64
17	I do a good job teaching patients about their health.			0/71		0/56
20	Teaching patients is essential to being a good doctor.			0/70		0/50
19	I enjoy teaching patients.	0/39		0/67		0/66
35	I would like to be a better teacher for my patients.			0/63		0/46
27	I teach the importance of developing long term relationships with patients.			0/54		0/41
13	I frequently talk to colleagues about teaching.				0/80	0/70
15	It is helpful to be able to discuss the progress of students and/or residents with colleagues.				0/62	0/62
12	I read journals about medical education, e.g., Academic Medicine.				0/48	0/40
16	I enjoy sharing ideas about teaching.		0/28		0/47	0/50
33	I would like to be a more skillful teacher.				0/43	0/51
Rotation Sums of Squared Loadings	Total	3/18	2/98	2/64	1/90	
	% of Variance	15/88	14/91	13/19	9/48	

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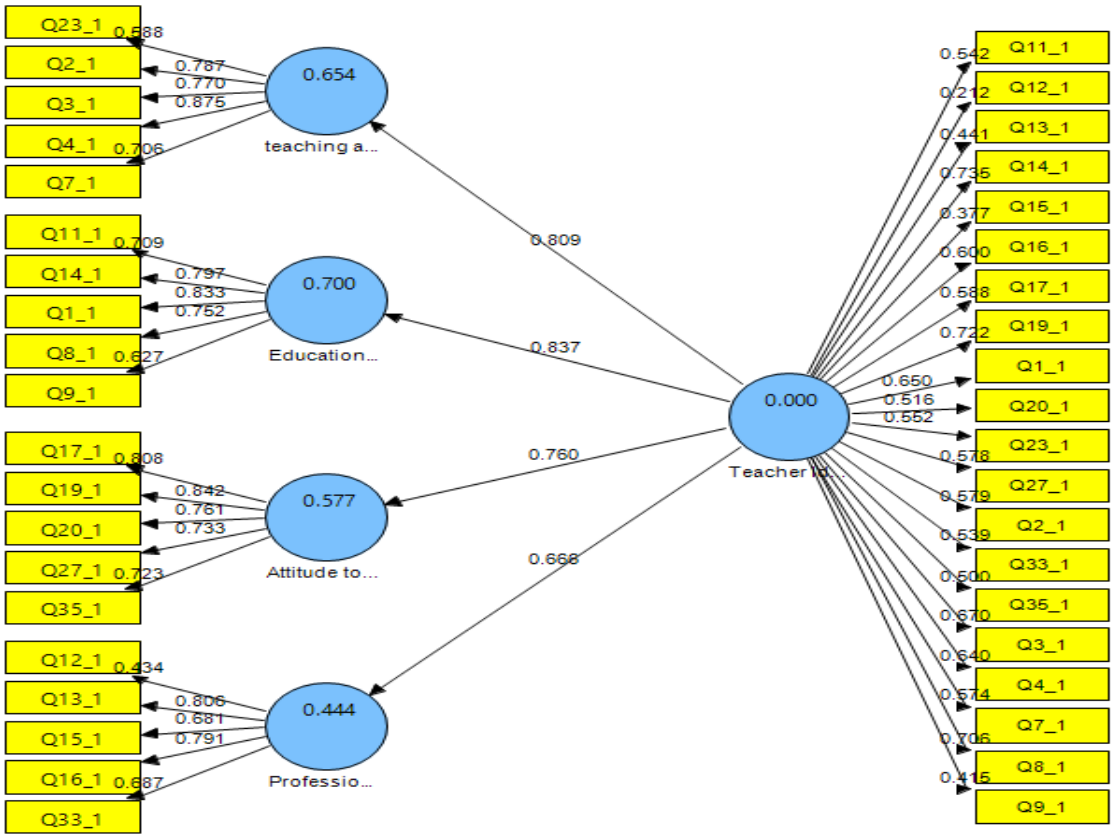

Figure 1: Hierarchy of factors and questions of factors

Does the short version of teacher identity for medical faculty members have acceptable reliability indices? Table 3 shows the standard factor load and significance of *t* at the confidence level of 95% for each of the items and factors.

Composite reliability evaluates the adequacy of the items of a single factor in its measurement, which has been proposed by Verse et al. (38). Composite reliability of more than 0.7 denotes internal consistency. It is also notable that composite reliability is a better criterion than alpha. As a result, the coefficients of all the hidden variables are morethan0.7,whichisacceptable.Table3 shows theCronbach'salphacoefficientsofthe research variables,and0.6wasconsideredtobeacceptable forthevariableswith limited items (39).

The significance of path coefficients only demonstrates the accuracy of correlations and not the severity of the correlations between the constructs. Considering that the path coefficients were more than 2.58, it could be concluded that the correlations were accurate at the confidence level of 0.99 (36).

The determination coefficient indicates the

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severity of the effect of the external variable on the internal variables. This index has the ability to reduce errors in the measurement model and increase the variance between the constructs and indices, which can only be controlled in PLS. The three values of 0.19, 0.33, and 0.67 were defined as poor, medium, andhightodenotetheseverity of the correlations (40), and the determination coefficients were within the acceptable range in this regard.

The criterion of predictive power for the model has been proposed by Stone-Geisser, which verifies the predictive ability of the indices associated with the internal constructs of the model. With respect to the severity of the predictive power of the model, the three values of 0.02, 0.15, and 0.35 have been determined (41). In the current research, the values of all the variables were acceptable.

Table 3: Measurement model and partial evaluation indicators

Factor	Indicator	Indicators			Factors		
		loading	T-Statistic	R Square	Cronbachs Alpha	Composite Reliability	Predictive Relevance Q^2
The field of teaching and learning	a4	0/87	23/51	0/75	0/801	0/864	0/362
	a2	0/78	9/36	0/61			
	a7	0/71	7/85	0/50			
	a3	0/77	9/17	0/59			
	a23	0/59	4/52	0/34			
Educational field	a1	0/83	17/85	0/68	0/802	0/862	0/380
	a9	0/63	5/46	0/39			
	a11	0/71	8/58	0/50			
	a14	0/79	17/4	0/62			
	a8	0/75	10/31	0/56			
Attitude to medical education	a20	0/76	8/49	0/57	0/833	0/882	0/341
	a17	0/81	11/63	0/65			
	a35	0/72	10/51	0/52			
	a19	0/84	19/44	0/70			
	a27	0/73	9/04	0/53			
Professional development	a13	0/80	7/25	0/64	0/727	0/816	0/199
	a15	0/68	5/03	0/46			
	a12	0/43	2/14	0/19			
	a16	0/79	8/85	0/62			
	a33	0/69	8/85	0/47			

Does the short version of the scale of teacher identity scale for medical faculty members have proper validity indices? Convergent validity is the assessment of the extent to which the hidden variable is explained by the items of a scale, which could be performed based on the average variance extracted (AVE) criterion. This criterion was proposed

by Fornell and Larcker, who considered the value of more than 0.5 acceptable (42). Meanwhile, Magner et al. considered the value of more than 0.4 to be adequate in this regard. The results presented in Table 4 indicate that all the hidden variables had proper convergent validity (43).

Table 4: correlation matrix and divergent narrative of Fornel and Larker

No	Factors	AVE	1	2	3	4
1	**The field of teaching and learning.**	0/56	0/75			
2	**Educational field**	0/55	0/539	0/74		
3	**Attitude to medical education.**	0/61	0/437	0/455	0/78	
4	**Professional development.**	0/48	0/352	0/439	0/425	0/69

Table 4 also shows the data on the divergent validity of the factors. In comparison with the other factors, a single factor must have more distinction among its related items, so that the factor would have higher divergent validity. Regarding divergent validity, we aimed to determine the extent to which a single factor could explain the variances of a set of items in competition with the irrelevant, uncalculated, external factors. If a factor is able to determine the maximum variance within a set of items and have fewer correlations with irrelevant factors, it is confirmed to have divergent validity. According to Fornell and Larcker, it is essential that the root convergent validity of each hidden variable is higher than its correlation with the other hidden variables (10). Therefore, the root convergent validity (numbers placed diagonally in the table) was higher than the correlation of each factor with the other factors, denoting that all the factors in the teacher identity scale for medical faculty members had divergent validity.

Discussion

The present study aimed to develop and validate the short version of the teacher identity scale for medical faculty members. To this end, an initial questionnaire was prepared based on a pilot study and similar instruments, especially the 37-item scale developed by Tabatabaei et al. (10). Following that, some of the items were modified and corrected based on Cronbach's alpha and their correlations with the entire questionnaire. Using heuristic factor analysis, the four dimensions of educational domain, teaching and learning, attitude toward medical

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education, and professional development were considered as underlying factors and constituents of the short version of teacher identity scale for medical faculty members. The mentioned factor structure was assessed and confirmed using confirmatory factor analysis based on the newest statistical techniques of structural equation modeling using PLS. There were 37 items in the initial scale proposed by Tabatabaei et al. (10), 20 of which were correlated with these four factors.

According to the experiments in the current research, despite the variations in the underlying factors of teacher identity, there were significant overlaps among these factors. The four dimensions of teacher identity for medical faculty members could be distinguished as the educational domain, teaching and learning, attitude toward medical education, and professional development. Therefore, the obtained results regarding the determination of the underlying factors of teacher identity were based on the mentioned studies in this regard. In a study, Heydari and Rezaei concluded that professional identity consists of the two dimensions of scientific identity and personal identity (44).

In a qualitative study in this regard, Foroutan and Reshadatjoo developed a model of professional identity for faculty members, consisting of underlying, personal, sociocultural, professional, political, and economic concepts as the general domains (25). Furthermore, in the qualitative research by Ashghali Farahani, Rafiei, and Emamzadeh Ghasemi, the two main classifications of internal factors (individual characteristics, functional properties, and experience of teaching in schools) and external factors (teaching competency of nursing instructors) were achieved. The internal factors included, and the external factors included organizational and environmental conditions (45).

In the study by Chung, the identity and professional services of the teacher were summarized in the form of five factors, including the teaching and learning domain, progress of students, progress of school, services and professional relations domain, and personal growth and progress (16). In the studies by Star et al. (30) and Tabatabaei et al. (10), the teaching identity of physicians was assessed and validated based on nine factors, including the universal characteristics of a teacher, inner satisfaction with teaching, teaching knowledge and skills, membership in the group of teachers, belief in the equality of teaching and being a physician, responsible teaching, sharing

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specialized clinical skills, and receiving awards for teaching.

Despite the variations in the titles of the mentioned studies, they have reached uniform conclusions based on their internal themes and concepts. However, the effects of native conditions on the outcomes of the measurement models cannot be overlooked. Evidently, there are different cultures regarding quality and the expectations of quality at different times and places. Therefore, for cultural adaptation, we attempted to use the phrases and expressions that most corresponded to the culture of the medical community in the translation of the questionnaire. Following that, the translated version of the questionnaire was reviewed and approved by some specialists in medical and educational sciences.

No other studies have been focused on the teaching identity of physicians in Iran. As for foreign studies, the only available research has been conducted by Star et al. (7, 30), while some studies have assessed the professional identity of teachers, faculty members, and nurses. For the first time in Iran, Tabatabaei et al. validated the long version of the teacher identity of physicians in the community of faculty members (10). The present study aimed to develop and validate the short version of teacher identity of medical faculty members based on the study by Tabatabaei et al.

Various indices are assessed in the evaluation of validity, including factor validity, discriminate validity, and diagnostic validity. Construct validity refers to the extent to which the entire indicators accurately reflect the concept of a construct (46). The two indices of validity assessment include convergent validity and divergent validity, which were investigated in the current research. According to the findings, the mentioned indices were all acceptable.

Validity sensitivity is considered to be the foremost feature of every measurement tool. In fact, validity indicates the proper measurement of the factor that the instrument has been developed to measure. Although there are also other criteria for the assessment of validity, they were not investigated in the present study for various reasons. However, we evaluated several indices to support the general concept of validity. In addition to content validity and face validity, construct validity is one of the most important aspects of validity (47). In the current research, these indices were studied through convergent and divergent validity. Therefore, it could be concluded that although we cannot be certain

about the specificity of the underlying factors and factor structure of the short version of the teacher identity scale for medical faculty members in Iran, we can confirm its validity and general concept.

Conclusion

According to the results, the short version of the teacher identity scale for faculty members had acceptable factor structure, reliability, and validity. Therefore, it could be used in the research activities to assess the teaching identity and professional identity in the field of medicine. Moreover, considering the short version of the scale, it could be easily implemented in this regard. It is recommended that the other components of this scale be investigated in other populations in order to generalize the findings.

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