Development and validation of a questionnaire for professionalism in cyber users in medical sciences in Iran

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Abstract:
BACKGROUND: Considering the importance of virtual professionalism and professional ethics in medical sciences, and the necessity to pay attention to this issue and its impact on medical professionalism, this study aimed to build a professional culture questionnaire in a virtual environment for students of medical sciences in Iran.

MATERIALS AND METHODS: This is an exploratory, sequential, mixed-methods research which was conducted in three sections. In the first section, the concept of e-professionalism in medical sciences was analyzed using the hybrid concept analysis in the theoretical work, field work, and final analysis stages in order to extract information related to the concept. In the second section, an item of the questionnaire was designed based on the concept, reviewed texts, and related questionnaires, in the third section, psychometric properties of a questionnaires were evaluated.

RESULTS: Totally, 39 items were included in the initial pool, which reduced to 33 items in the final questionnaire after reviewing the psychometric properties. Factor analyses led to extraction of five factors including appraisal of e-professionalism compliance with the laws and regulations governing cyberspace, individual professionalism, knowledge management, respect for professionalism in interpersonal and group rules, and complying with ethics in the use of cyberspace. The internal consistency of questionnaire was also confirmed by Cronbach’s alpha coefficient of 0.78, also all factor correlations absed stability were significant (P < 0.05).

CONCLUSION: An exploratory sequential study in this study led to the extraction of five factors and development of a 33-item questionnaire in e-professionalism. As results and analysis of the psychometric properties and validation of each item, this questionnaire is valid and reliable for the assessment of levels of e-professionalism in medical sciences in Iran.

Keywords:
Cyber ethic, e-learning, Internet, medical ethic, medical sciences, netiquette, professionalism, social media, virtual learning

Introduction

In recent years, with development of technology related to information and communication technology (ICT), the impact of technology on human thinking has also grown dramatically. Despite the ease of communication, using the technology may be led to the transformation of identities and loss of human being in the virtual space. [1]

Like earlier digital instruments, mobile phones pave the way for new types of communication and interaction, which can also specify new paths to teaching. [1,2] In addition, generally speaking, participants have a positive view point concerning technology and investments in technology by universities and their workplace, despite the fact that their attitudes on applying such technologies for educational purposes remain obsolete. The majority of them determined laptop as the most effective...
ICT for education and learning, followed by learning management systems and smartphones.\cite{3}

In some studies, it has been reported that mobile phones are used for educational purposes in clinical environments to access learning materials.\cite{4,5} In addition, e-learning could effectively enhance learners’ knowledge and performance compared to traditional learning and improved students’ clinical performance.\cite{6-10}

Internet-assisted mobile phones have growingly led users to access social networking sites. In fact, statistics make it possible for smartphone users to spend significantly more time on social media and social networking sites than personal computer users. Again, medical and health research has concentrated on the use of social media in high-income countries.

Such technologies enable educational participation of users outside local communities.\cite{11} Other research has

**Figure 1:** Flow diagram of the development and psychometric properties of e-professionalism in medical sciences in Iran. EFA = Exploratory factor analysis, ICC = Intraclass coefficient, CVR = Content validity ratio, CVI = Content validity index
shown that technology has educational merits in addition to perils associated with ethical issues and privacy.[12]

Earlier studies propose that using smartphones in medical centers would not only improve clinical practice but also increase patient care quality and effectiveness, even in developing countries.

Some organized reviews demonstrate that handheld computers provide health-care professionals with easy and opportune access to information, decision-oriented evidence support, and patient management systems, which leading to improved clinical decision-making.[13]

Furthermore, there is technology-based education specifically designed for health-care professionals such as guidelines, e-book, medical calculators, medical guidelines such as drug guidelines, as well as applications that permit health-care professionals to perform numerous tasks at point of care. This also helps from social signs and concerns health team to communicate with colleagues effectively.[6,8,12,14-16]

Even though the principles and obligations for medical professionalism already exist, we believe that various doctors may have difficulty in using these principals to their online practices at least due to the following three reasons. First, some of the online contents in both medical literature and mass media might not clearly violate the principles of medical professionalism. The second is that many people experience a lower level of embarrassment in their online practices. Social media in particular can create the anonymity and detachment from social sign and consequences of on line action. The potential of such carelessness is much greater than the usual face-to-face interactions due to wide range of media.[17,18]

The Internet has made capability for medical students and doctors to interact, share information rapidly, and reach to million of people easily. Taking part in social networking and other parallel occasions can support doctors' personal expression, enable them to have a professional presence online, nurture collaboration and friendship among them, and offer chances for extensively spreading public health messages and other health communications. Studies are now demonstrating how social media can improve medical practice and online presence.[15,19,20]

Conventionally, professionalism has been characterized as a traditional value system, accompanied by faith, specialized knowledge, and decision required to cope with risk in public service. However, critics claim that professionalism is not a way of exist; instead, it is an conceptual discourse used to promise job-related inhibition and control.[21]

We are required to nurture new understandings of how Internet and social media influences professional margin issues, online identities, relations with patients and other sponsors, and professional learning. While studying these issues, we are possible to observe both new guiding principle for professionalism and cultivate new notions of professionalism.[22]

Considering the importance of virtual professionalism and professional ethics in medical sciences, and the necessity to pay attention to this issue and its impact on medical professionalism, this study aimed to build a professional culture questionnaire in a virtual environment for students of medical sciences.

Materials and Methods

Aim
This study aimed to build a professional culture questionnaire in a virtual environment for students of medical sciences.

Design and setting
In this study, which was carried out in three stages, a hybrid study was used at the first stage.

This study is a qualitative study with a hybrid approach that consists of the following three stages: theoretical stage, field research, and analysis. The hybrid model is one of the methods of conceptualization, evolution of concept, and the development of theory, and this method is used to eliminate abstractness and ambiguity of concepts, which will be explained in sequence. This model is applicable in practical and clinical sciences and in explaining important phenomena.

The three stages of theoretical phase, the stage of work in the context, and the final analysis, form different stages of the model.[23,24]

In the first phase, a systematic review was carried out using the Cochrane Community Search Strategy. The databases were searched including PubMed, ProQuest, Scopus™, Web of Science®, Science Direct, Google Scholar without time limit until the end of 2018.[25]

In the next study with purpose of developing virtual professional codes to examine the indices and themes identified in the previous study, adaptive code and code list were extracted.

In the second stage of the research, expert opinions were collected on the initial draft of the codes so that the meetings of the centralized expert group with the presence of five experts were convened. All of these experts have interdisciplinary experiences or education
in three areas of ethics, education, and medicine, including two faculty members of the university, with education and experience in the field of medical education, two with medical education and experience, and a faculty member nurse with extensive research in the field of virtual vocational codes. In these meetings, among the reached collections, the participants chose professionalism-specialized codes in the virtual environment, with emphasis on medical education.

In the third stage, the set of obtained codes was validated and finalized. Then, the validation criteria including content validity and then structural validity and reliability were considered [Figure 1].

In the process of designing a questionnaire, the following steps were taken into consideration:

To prove validity of the research tools, there are several ways that include content validity, formal validity, criterion validity (prerequisite and concurrent), construct validity (convergent, divergent, and internal consistency and factor validity), age differentiation, evolutionary change, and group differences. In this study, content and formal and exploratory convergent content were used.

Hence, the research samples at this stage comprised national-level experts, twenty faculty members in the field of virtual science, and professors participating in the Ethics Workshop at the virtual campus of the National Congress of Medical Education (2018). To this end, relevant topic-related scholars were asked to express their views on the product of the second stage, in terms of the clarity of the contents of each code and the ability to perform, or, if necessary, more codes in this field with an emphasis on the professionalism in the field of virtual education. The next step was to check the code changes by the executives on the basis of the agreement. During a meeting, codes were reviewed in each area, and final changes were made to change, add, or remove them. Finally, the codes for professionalism in virtual education in the field of science were developed in a group of researchers based on agreement.

In the study of content validity indicators, two indicators were used: (a) Content Validity Ratio (CVR): This indicator was designed by Lavashe.[26]

This index is based on the views of experts specializing in the content of a test so that each of the questions is based on a 3-point Likert scale, which is categorized as “the item is necessary,” “the item is useful but not necessary,” and “the item is not necessary.”

(b) Content Validity Index (CVI): In order to examine the CVI, experts determined the relevance extent of each item in the following order, from their own point of view: 1 “is not relevant,” 2 “is relatively related,” 3 “is relevant,” and 4 “is completely relevant.”[26-28] In this study, the coefficients of calculation are as follows: the CVR and CVI indicators were examined in this part. The amounts of CVR and the CVI were obtained as 0.60 and >0.79, respectively.[29,30]

**Initial implementation of test**

In this stage of the construction of a test, a designed questionnaire, whose formal and content validity have been reviewed, was initially carried out on a limited number of target group, and re-evaluation was used to calculate the reliability coefficient.

The next step is to run the questionnaire on the target group.

At this stage of a test, the designed test on the target group was fully implemented to examine other types of validity and reliability of the test.

**Analysis of questions by factor analysis method:** Factor analysis is a combination of a number of statistical techniques and aims at simplifying complex data sets. The main objective of factor analysis is to simplify the description of data by reducing the number of variables or dimensions studied.

Therefore, exploratory analysis is considered more as a method of theoretical formulation, rather than a theoretical test method. In confirmatory factor analysis, the goal of the researcher is to confirm a particular factor structure. It is expressly hypothesized about the number of factors, and the fit of the desired factor structure in the hypothesis is tested with the covariance structure of the measured variables.[26]

(c) Initial reliability: In this part, correlation coefficient between items and the whole questionnaire were determined using Cronbach’s alpha coefficient. Moreover, inter-item correlation coefficient was performed by thirty students.

(d) Construct validity: Exploratory factor analysis (EFA) was applied to determine the construct validity of e-professionalism in medical students. EFA has been used to determine the relationship between items and summarize related items in a class.[30]

Bartlett’s Test was used to evaluate the correlation between the items of a questionnaire in order to integrate them and the Varimax rotation was used to interpret the factor structure by taking eigenvalues >1.[31]

**Final reliability**

Reliability of the e-professionalism questionnaire
in medical sciences was investigated using internal consistency and stability. In order to evaluate the internal consistency, a questionnaire was completed by thirty students in different fields and then Cronbach’s alpha coefficient was calculated. Alpha coefficient above 0.7 was considered adequate for the reliability. \[32\]

To test the stability of the questionnaire, a test–retest method was used. The questionnaires were completed by twenty students on 2-week intervals. Afterward, the correlation of scores between the two tests was calculated with intra-class correlation coefficient (ICC). ICC above 0.8 reflects the acceptable stability of the questionnaire.

### Results

In the analysis of a questionnaire, EFA method was used. The method used in the factor analysis is the main component method with a Varimax rotation. The Kaiser–Meyer–Olkin (KMO) index and the Bartlett’s test are as follows: According to Table 1, the KMO index is calculated to be 0.619, which

### Table 1: KMO and Bartlett’s tests in the questionnaire

| KMO and Bartlett’s Test | Statistical value |
|-------------------------|-------------------|
| KMO measure of sampling adequacy | 0.619 |
| Bartlett’s Test of Sphericity | | |
| Approximate Chi-Square | 4431.751 |
| df | 741 |
| Significant | 0.000 |

KMO=Kaiser–Meyer–Olkin

### Table 2: Shared Value of each questions

| Question                                                                 | Shares |
|--------------------------------------------------------------------------|--------|
| The ability to find up-to-date resources on Internet sites                | 0.745  |
| The ability to distinguish valid sources from non-valid                  | 0.798  |
| Ability to manage resources and mass data to achieve specialized findings| 0.740  |
| Understanding the most up-to-date and functional software tailored to the needs | 0.725  |
| Applying up-to-date software and applications at work                    | 0.562  |
| The art of analyzing content in cyberspace and identifying its validity  | 0.773  |
| Familiarity with a variety of file formats and ways to convert and modify them | 0.826  |
| Familiarity with specialized sites                                       | 0.714  |
| Managing the use of Internet resources in search and use                  | 0.709  |
| Using virtual storage spaces to store information                         | 0.816  |
| Complying with the media regime in the use of cyberspace                 | 0.664  |
| Respecting the privacy of individuals in entering cyberspace              | 0.755  |
| Attention to the values and intellectual and cultural interests of the group in the publication of virtual content | 0.745  |
| Assessing the value of content in target groups before sending it         | 0.713  |
| Not going too far in sending bulk contents in interest groups             | 0.606  |
| Possessing appropriate literature for the publication of virtual works and content | 0.722  |
| Commitment to the goals and rules of grouping on the use of social networks | 0.857  |
| Non-publishing of immaterial content in cyberspace                        | 0.787  |
| Having the art of discussion and dialogue in collaborative environments   | 0.725  |
| Enjoying the art of criticism and critique in a virtual group environment | 0.854  |
| Considering the privacy of individuals in using resources and information | 0.799  |
| Understanding the rules and regulations for the use of virtual spaces    | 0.674  |
| Respecting intellectual property rights (copyright) in accordance with the rules for the use of virtual content | 0.817  |
| Getting permission from the authors of resources and then using them      | 0.772  |
| Professional commitment to business in cyberspace                         | 0.743  |
| Using the names of the content authors in the referrals                   | 0.660  |
| Not logging into resources through blockers and locksmiths if their use is restricted | 0.799  |
| Recognizing customers and their Needs                                    | 0.747  |
| Using the right technology in advertising and business                    | 0.779  |
| Commitment to customers and their needs in advertising and business       | 0.682  |
| Respecting all guidelines and regulations regarding the supply of goods and services in the electronic environment | 0.772  |
| Not creating pseudo-worthless sites in cyberspace                         | 0.730  |
| Not transmitting non-valid news and rumours on channels, groups and virtual spaces | 0.777  |
| Logical use of time spent on the web                                      | 0.755  |
| Not manipulating information in virtual spaces                            | 0.759  |
| Honesty in declaring personal identity in virtual spaces                  | 0.751  |
| Non-publication of images and immoral content inappropriate to the culture and norms of society | 0.791  |
| Introducing one’s role in cyberspace                                     | 0.783  |
| Non-publication of unsafe content anonymously in cyberspace              | 0.674  |
is fairly reasonable and acceptable. In addition, the \( P \) value of Bartlett’s spire test is <0.001, which indicates that correlation coefficients between questions are appropriate for performing factor analysis.

The shared value of each question is given in Table 2. According to this table, it is seen that the shared values of questions are high (most often above 0.7) and therefore no questions can be deleted.

Initially, all the 39 questions for performing EFA were taken into consideration.

For the extraction of factors, the main components and Varimax rotation method were used. The minimum acceptable value for special values was equal to 2, which resulted in the extraction of five factors that accounted for 51.06% of the total variance, which is an acceptable value [Table 3].

According to Table 4, five factors were extracted, and related questions for each factor were determined as follows:

**Reliability using Cronbach’s alpha (for internal consistency assessment)**

With regard to the extraction factors and related questions, reliability was determined using Cronbach’s alpha method as follows:

It seen that except the third factor, the alpha value for other extractives was at an acceptable level. By reviewing the third factor, it was found that if the question 20 was deleted, the alpha value would be increased to 0.581. Therefore, at this stage, question 20 was removed from the questionnaire set. Finally, the alpha value was calculated as follows [Table 5]:

- Investigating the relationship between each item and entire questionnaire:
  The correlation coefficient of each question with the total score of a questionnaire is presented in Table 6
- Investigating the relationship between each factor and total questionnaire:
  - The correlation coefficient of each extraction factor with the total score of a questionnaire is given in Table 7

Reliability was tested by test–retest method. The test was repeated on twenty people. The test–retest was 0.812, which is a good value.

Correlation coefficient was also investigated with professional attitude questionnaire in social networks.[33]

This questionnaire has ten questions and five areas in the field of professionalism toward virtual networks.

### Table 3: Principal components analysis of e-professionalism in medical sciences (n=250)

| Question | Factor 1 | Factor 2 | Factor 3 | Factor 4 | Factor 5 |
|----------|----------|----------|----------|----------|----------|
| q22      | 0.808    |          |          |          |          |
| q21      | 0.781    |          |          |          |          |
| q18      | 0.714    |          |          |          |          |
| q17      | 0.688    |          |          |          |          |
| q25      | 0.640    |          |          |          |          |
| q26      | 0.618    |          |          |          |          |
| q24      | 0.602    |          |          |          |          |
| q23      | 0.590    |          |          |          |          |
| q14      | 0.551    |          |          |          |          |
| q11      | 0.767    |          |          |          |          |
| q30      | 0.697    |          |          |          |          |
| q15      | 0.626    |          |          |          |          |
| q35      | 0.613    |          |          |          |          |
| q39      | 0.584    |          |          |          |          |
| q3       | 0.555    |          |          |          |          |
| q4       | 0.522    |          |          |          |          |
| q6       | 0.398    |          |          |          |          |
| q31      | 0.396    |          |          |          |          |
| q13      |          | 0.726    |          |          |          |
| q10      |          | 0.687    |          |          |          |
| q9       |          | 0.589    |          |          |          |
| q20      |          | -0.562   |          |          |          |
| q7       |          | 0.461    |          |          |          |
| q19      |          | 0.397    |          |          |          |
| q36      |          |          | 0.758    |          |          |
| q38      |          |          | 0.716    |          |          |
| q37      |          |          | 0.584    |          |          |
| q1       |          |          | 0.499    |          |          |
| q8       |          |          | 0.495    | 0.409    |          |
| q12      |          |          |          | 0.688    |          |
| q5       |          |          |          | 0.567    |          |
| q2       |          |          |          | 0.551    |          |
| q32      |          |          |          | 0.430    |          |
| q27      |          |          |          | 0.428    |          |

| Eigenvalue | 4.739 | 4.211 | 3.338 | 2.582 | 2.493 |
| % of variance | 13.937 | 12.384 | 9.818 | 7.594 | 7.333 |
| % of cumulative variance | 13.937 | 26.321 | 36.139 | 43.733 | 51.066 |

### Table 4: Factors and questions extracted from questionnaire

| Factor | Related Questions |
|--------|-------------------|
| 1. Compliance with the laws and regulations governing cyberspace | 21-22-23-28-24-26-23-25-29 |
| 2. Individual professionalism in using cyberspace | 11-30-15-35-3-39-4-2-6 |
| 3. Knowledge management and information literacy | 1-10-9-20-7-8 |
| 4. Respect for professionalism in interpersonal and group rules | 12-27-19-13-32 |
| 5. Complying with ethics in the use of cyberspace | 36-38-8-31-37 |
including accountability, hiring decisions, profile edits, professionalism, and privacy settings. The results showed that internal consistency of questionnaire was confirmed. \((r = 0.69, P = 0.004)\).

### Discussion

The results of this study indicate that professionalism questionnaire of cyberspace users in medical sciences has a good validity and reliability. The results of the EFA showed that there are five distinct dimensions. Dimensions are as follows: compliance with the rules and regulations governing cyberspace with nine items, individual professionalism in use of cyberspace with nine items, knowledge management and information literacy with five items, professionalism in interpersonal and group rules with five items, and ethics of the use of cyberspace with five items. All of them were the most effective factors in each dimension. These 33 items predict 51.06 of the total variance, which is a good percentage for a questionnaire. In addition, the Cronbach’s alpha was 0.781 and factors were 0.861, 0.746, 0.581, 0.550, and 0.694, which indicates the acceptable internal consistency of a questionnaire and that of its subscales. In explaining results obtained from the factor analysis, one can refer to a research that addresses the emergence of new e-professionalism and social networks, which, after explaining the subject and reviewing previous research and evidences, has proposed the following recommendations: The exploratory factors of the present study are consistent with the following:

- Awareness and updating of information on rules and regulations of regulatory agencies; Internet privacy policies and their compliance; appropriate media literacy; honesty in the introduction of virtual identity; continuous monitoring of online activity; respect for intellectual property rights and e-commerce; respecting privacy of official, personal, and friendly relations; and avoiding the publication of nonspecialized content.\(^{[34]}\)

Of course, it should be noted that these five items and factors do not mean that the professional boundaries are ignored in accordance with the general guidelines of professional ethics. However, any virtual activity in medical sciences, in addition to general practice of professionalism in the field of medical sciences, including compliance with patients’ privacy rights and competencies of the doctor’s professional relationship with patients, peers, and colleagues, also requires compliance with specific issues of cyberspace use.

### Conclusion

Considering the lack of a similar and indigenous standard questionnaire for measuring the professionalism of
cyberspace in medical sciences, it seems that a prepared questionnaire can address this need. However, the spread of the use of the Internet in various areas of health care and medical education, especially the advent of doctors in new areas such as telemedicine and e-health, e-consulting, and e-learning, also emphasizes the impact of online medical professionals on real life. [39]

It is important to pay attention to the professionalism of the use of cyberspace in order to maintain the confidence of the physician and the patient and maintain the health service credit.

The developed 33-item-questionnaire is valid and reliable for the assessment of levels of e-professionalism in medical sciences in Iran.

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Ethics approval and consent to participate
First, the approval for the study was obtained from the Ethics Committee affiliated to Jahrom University of Medical Sciences COD of IR. JUMS. REC.1398.039.

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Conflicts of interest
There are no conflicts of interest.

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