

Influencing Factors of Professional Identity of Medical Undergraduates under Online Teaching Mode in China

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Abstract: ‘Internet+’ education, as an important trend in the development of education cause in the new era, is an inevitable choice to promote the modernization of education. Colleges and universities across the world have carried out teaching reforms to adapt to this brand-new educational form. Especially during the epidemic, online teaching mode has been widely carried out. Colleges and universities have focused on building online teaching platforms to improve the quality of education. This online teaching mode, especially the wide application in medical colleges, has a complex impact on the medical education which was characterized of practicality. Whether the students’ professional identity changes due to the shift of teaching mode needs to be explored and studied. The aim of this study was to investigate the current status of medical undergraduates’ professional identity during online teaching and its influencing factors. The method applied in this paper was conducted in a medical college in East China in 2022. A questionnaire was used to investigate the status of professional identity, self-directed learning, richness of curriculum resources, teacher-student interaction and clinical contact of medical undergraduates during online teaching. 718 medical undergraduates scored 3.73 ± 0.57 in professional identity, which is at a moderate level. Professional identity during online study is significantly influenced by the following factors: grade, specialty, online course resources, teacher-student interaction, clinical contact, and self-directed learning ability. Measures to improve these aspects should be adopted to strengthen the professional identity of medical undergraduates.

The development of ‘Internet+’ promotes the integration of information network technology with education and teaching. In the field of medical education, its characteristics of sharing, diversification and convenience accelerate the construction of a new education system of ‘new medical science’ in China. While ‘Internet +’ education brings opportunities to medical education, it also brings many challenges ^[1]. During the epidemic, most medical colleges adopted online teaching mode for medical education. Face-to-face classroom learning turned into online learning,

and the clinical contact that should have been performed in hospitals was also transferred to the Internet. Some researchers believe that this teaching mode, which is separated from the actual clinical setting, has a negative impact on the development of professional identity among medical undergraduates^[2].

Professional identity refers to an individual's attitudes, feelings, and overall perceptions of their profession, which constitute essential characteristics of their profession^[3]. Medical students' professional identity encompasses their perceptions of future careers and physician roles. It is the starting point of medical students' personal development and an important part of medical students' career development. In medical education, professional identity development refers to the thinking, feeling and acting like a doctor^[4] and is a continuous and dynamic process that should run through the entire medical education from the basic stage of medical students, preclinical internship stage to the clinical stage.

Medical students' professional identity is influenced by teaching methods^[5]. Due to the widespread use of online teaching mode, learning effects of medical undergraduate students have been impacted^[6], which may lead to changes in the professional identity of medical undergraduates.

Since the implementation of online teaching, knowledge acquisition is more dependent on students' self-directed learning. Self-directed learning refers to learners' autonomous acquisition of knowledge and skills, and active use of a series of cognitive and non-cognitive strategies to solve various problems in order to achieve individual and social development goals^[7]. The self-directed learning of medical undergraduates during online teaching plays an important role in their academic and professional cognitive development. Nowadays, medical students' web-based independent learning is of great significance for their professional identity development. However, no studies have discussed the impact of self-directed learning on medical undergraduates' professional identity based on online teaching mode.

In addition, for medical undergraduates, clinical practice plays an important role in the development of professional identity. Shikama^[8] believe that the development of medical undergraduates' professional identity requires the involvement of a 'role model doctor'. The presence or absence of model doctors has a huge impact on the interaction between teachers and students, and the effectiveness of medical teaching. Clinical practice led by role model doctors is dramatically different from clinical practice simulated only through the network. In the former case, the timely assistance of role model doctors makes medical undergraduates have stronger judgment ability in the face of complex doctor-patient relationships and multi-faceted evaluation of doctors' careers, thus maintaining a correct perception of career prospects; While, students exposed to clinical practice through network easily have negative views on doctors' careers due to some non-objective evaluations. During the implementation of online teaching, medical undergraduates have less access to clinical practice, and the connection between medical undergraduates and their role model doctors is weakened to some extent, which may affect the professional identity of medical undergraduates.

Therefore, the aim of this study was to (1) investigate the current status of medical undergraduates' professional identity and its relationship with medical self-directed learning; (2) explore other related factors of medical undergraduates' professional identity during online teaching. Based on the research data, this study put forward the methods and strategies to improve the professional identity of medical undergraduates, and provides a theoretical basis for improving the teaching quality of medical education.

1. Objects and methods

1.1 Objects

A simple random sampling method was used to select undergraduates from medical colleges in China as the study subjects. Inclusion criteria: (1) full-time undergraduate students; (2) having received online teaching for more than three weeks. Exclusion Criteria: Students who asked for leave during online teaching or did not follow the teaching schedule exactly.

1.2 Questionnaires

The questionnaire consists of three parts: online learning, self-directed learning and professional identity.

The first part of the questionnaire was designed by the study group through consulting the relevant literature, including general demographic characteristics (gender, grade, specialty), richness of curriculum resources, teacher-student interaction, and clinical contact during online teaching.

Self-directed learning was assessed using the Medical Students' Self-directed Learning Ability Scale^[9]. The scale consists of 30 items and contains two dimensions namely self-motivation beliefs and objective behavior. The Likert five-level scoring method was used for the scale, and the higher the total score, the stronger the self-directed learning ability. The scale has good reliability and validity and is widely used in the assessment of self-directed learning of medical students.

Professional identity was measured using the Medical Students' Professional Identity Scale^[10], which contained six dimensions (professional cognition, professional affect, professional commitment, professional behavior, professional expectation, and professional values) for a total of 38 items. Likert 5-level scoring method was also adopted. Higher total scores indicate higher professional identity. The Cronbach's coefficient is 0.826 and split-half reliability coefficient is 0.929. The Scale has good reliability and validity, which is widely used in the assessment of professional identity of medical students.

1.3 Statistical data collections

Data collection for this study took place during online teaching in 2022. Online surveys were administered in the form of electronic questionnaires. All items in the questionnaire were asked to be filled in and the same IP address could only answer once. Excluding questionnaires that did not meet the screening criteria, 718 valid questionnaires were received in this online survey.

The research procedures of this project were conducted following the Declaration of Helsinki, and approved by the Academic Ethics Committee of Xuzhou Medical University. The approval number was XZMU-2022-ZK066.

1.4 Data analysis

Data analysis was performed using SPSS Statistics 28.0. Independent sample t-test and one-way ANOVA were used to compare differences in professional identity of medical undergraduates under general characteristics. Categorical variables were measured as percentages, while continuous variables were presented as mean \pm standard deviation. Correlative analysis was used to determine the relationship between the total and each dimension of professional identity and self-directed learning. The magnitude of the correlation was categorized as follows: $r \leq 0.25$ indicates very poor correlation; $0.25 < r \leq 0.50$ indicates poor correlation; $0.50 < r \leq 0.70$ indicates moderate

correlation; $0.70 < r \leq 0.90$ indicates high correlation; $r > 0.90$ indicates very high correlation. Multivariate linear regression was used to analyze the influencing factors of professional identity. All tests were two-tailed and $P < 0.05$ was considered statistically significant.

2. Results

2.1 General Status of Medical Undergraduate Professional Identity

As is shown in Table 1, the mean score of medical undergraduates' professional identity was (3.73 ± 0.57), which is at the upper medium level. The mean scores for each dimension range between 3.64 and 3.82, all of which are at the upper medium levels. Medical undergraduates scored the highest in terms of professional values and the lowest in terms of professional commitment. According to the standard deviation in the results, there is the largest difference in professional expectation (0.76), which indicates that medical undergraduates make more extreme choices in professional expectation.

Table 1: Medical Undergraduates' Professional Identity Questionnaire Scores.

	Total score	Cognition	Affect	Commitment	Behavior	Expectation	Values
Mean	3.73	3.69	3.78	3.64	3.67	3.79	3.82
Standard deviation (SD)	0.57	0.55	0.73	0.62	0.65	0.76	0.60

2.2 Single Factor Analysis on Professional Identity of Medical Undergraduate

Table 2: One-way ANOVA for Professional Identity of Medical Undergraduates (n = 718).

Variable		N	Mean	SD	F	P	Post-hoc Analysis
Gender	Male	274	3.79	0.59	2.188	0.029 *	
	Female	444	3.69	0.55			
Grade	1st year	326	3.82	0.57	8.008	0.000*	1 > 3*
	2nd year	149	3.76	0.53			1 > 4*
	3rd year	135	3.59	0.50			2 > 3*
	4th year	108	3.59	0.62			2 > 4*
Specialty	Clinical	276	3.89	0.55	14.004	0.000*	1 > 2*
	Anesthesiology	185	3.71	0.60			1 > 3*
	Nursing	123	3.56	0.51			1 > 4*
	Other	134	3.60	0.52			2 > 3*
Online Course Resources	1.Abundant	289	3.81	0.59	4.961	0.007*	1 > 2*
	2.General	333	3.66	0.54			
	3.Lacking	96	3.73	0.56			
Online Teacher-student interaction	1.Good	197	3.86	0.63	6.935	0.001*	1 > 2*
	2.General	378	3.69	0.53			1 > 3*
	3.Poor	143	3.67	0.55			
Online clinical contact	1.Good	129	3.84	0.68	4.220	0.015 *	1 > 2 *
	2.General	357	3.68	0.53			
	3.Poor	232	3.75	0.53			

* = $p < 0.05$, * = $p < 0.01$, * = $p < 0.001$.

Table 3: Multiple Comparisons of one-way ANOVA for Professional Identity of Medical Undergraduates (n = 718).

Variable	(I) Group	(J) Group	Mean Difference (I-J)	Standard Error	Significant
Grade	1st year	2nd year	0.059	0.055	0.287
		3rd year	0.231	0.057	0.000*
		4th year	0.227	0.062	0.000*
	2nd year	1st year	-0.059	0.055	0.287
		3rd year	0.172	0.066	0.010*
		4th year	0.168	0.071	0.017 *
	3rd year	1st year	-0.231	0.057	0.000*
		2nd year	-0.172	0.066	0.010*
		4th year	-0.004	0.072	0.958
	4th year	1st year	-0.227	0.062	0.000*
		2nd year	-0.168	0.071	0.017 *
		3rd year	0.004	0.072	0.958
Specialty	Clinical	Anesthesiology	0.177	0.052	0.001*
		Nursing	0.328	0.060	0.000*
		Other	0.288	0.058	0.000*
	Anesthesiology	Clinical	-0.177	0.052	0.001*
		Nursing	0.151	0.064	0.019 *
		Other	0.111	0.063	0.075
	Nursing	Clinical	-0.328	0.060	0.000*
		Anesthesiology	-0.151	0.064	0.019 *
		Other	-0.039	0.069	0.568
	Other	Clinical	-0.288	0.058	0.000*
		Anesthesiology	-0.111	0.063	0.075
		Nursing	0.039	0.069	0.568
Online Course Resources	Abundant	General	0.143	0.045	0.002*
		Lacking	0.075	0.066	0.258
	General	Abundant	-0.143	0.045	0.002*
		Lacking	-0.068	0.065	0.301
	Lacking	Abundant	-0.075	0.066	0.258
		General	0.068	0.065	0.301
Online teacher-student interaction	Good	General	0.167	0.049	0.001*
		Poor	0.191	0.062	0.002*
	General	Good	-0.167	0.049	0.001*
		Poor	0.023	0.055	0.675
	Poor	Good	-0.191	0.062	0.002*
		General	-0.023	0.055	0.675
Online clinical contact	Good	General	0.163	0.067	0.045 *
		Poor	0.087	0.070	0.516
	General	Good	-0.163	0.067	0.045 *
		Poor	-0.076	0.045	0.251
	Poor	Good	-0.087	0.070	0.516
		General	0.076	0.045	0.251

* = $p < 0.05$, * = $p < 0.01$, * = $p < 0.001$.

In this study, independent sample t-test was used to investigate gender difference in professional

identity of medical undergraduates. The result shows that male students (3.79 ± 0.59) score higher than female students (3.69 ± 0.55). One-way ANOVA results show that the differences in terms of grade ($F = 8.008, p < 0.001$), specialty ($F = 14.004, p < 0.001$), online course resources ($F = 4.961, p < 0.01$), teacher-student interaction ($F = 6.935, p < 0.001$), and clinical contact ($F = 4.220, p < 0.05$) are all statistically significant. Medical undergraduates have the highest professional identity scores: first year (3.82 ± 0.57), clinical specialty (3.89 ± 0.55), abundant curriculum resources (3.81 ± 0.59), good teacher-student interaction (3.86 ± 0.63), and good clinical contact (3.84 ± 0.68). Post-hoc analysis show that the professional identity of juniors is higher than that of seniors. Professional identity of Clinical students is higher than that of Anesthesiology, Nursing and other specialties. Results are presented in Table 2 and Table 3.

2.3 Relationship between Professional Identity and Self-directed Learning

The mean score of the total dimension of self-directed learning is (3.69 ± 0.58), and the mean scores of the two dimensions are self-motivation belief (4.03 ± 0.61) and objective behavior (3.57 ± 0.61). As shown in Table 4, there was a positive correlation between professional identity and autonomous learning in the total dimension and each dimension ($r = 0.541 \sim 0.763, p < 0.01$).

Table 4: Correlations between Self-directed Learning and Professional Identity Dimensions.

	Professional Identity	Cognition	Affect	Commitment	Behavior	Expectation	Values
Self-directed learning	0.728 *	0.610 *	0.622 *	0.610 *	0.763 *	0.626 *	0.585 *
Self-motivation belief	0.724 *	0.584 *	0.655 *	0.637 *	0.713 *	0.622 *	0.604 *
Objective behavior	0.682 *	0.580 *	0.570 *	0.561 *	0.732 *	0.587 *	0.541 *

** = $p < 0.01$.

2.4 Multiple Linear Regression Analysis on Professional Identity of Medical Undergraduates

We took self-directed learning as a dependent variable, and six factors that may affect professional identity (gender, grade, specialty, online curriculum resources, teacher-student interaction, clinical contact) as independent variables for multiple linear regression analysis. As shown in Table 5, seven factors including grade, specialty, teacher-student interaction, clinical contact, and self-directed learning, significantly predicted professional identity in medical undergraduates ($F = 71.154, P < 0.001$).

Table 5: Multiple Linear Regression Analysis of Medical Undergraduates' Professional Identity.

Model	Unstandardized Coefficient		Standardized coefficient	t	Sig.	Collinear statistics	
	B	SD				Tolerance	VIF
(Constant)	1.37	0.113		12.126	0.000*		
Gender (Ref: Male)							
Female	-0.027	0.029	-0.023	-0.939	0.348	0.957	1.045
Grade (Ref: 1st year)							
2nd year	-0.074	0.044	-0.053	-1.698	0.090	0.602	1.662
3rd year	-0.153	0.041	-0.106	-3.712	0.000*	0.725	1.379
4th year	-0.176	0.062	-0.111	-2.824	0.005*	0.378	2.642

Specialty (Ref: Clinical)							
Anesthesiology	-0.036	0.052	-0.028	-0.688	0.491	0.359	2.784
Nursing	-0.157	0.044	-0.104	-3.572	0.000*	0.692	1.446
Other	-0.258	0.039	-0.178	-6.600	0.000*	0.814	1.229
Course Resources (Ref: Abundant)							
General	-0.032	0.032	-0.028	-0.988	0.323	0.738	1.355
Absence	0.001	0.048	0.001	0.029	0.977	0.714	1.401
Teacher-student interaction (Ref: Good)							
General	-0.096	0.039	-0.085	-2.481	0.013*	0.503	1.988
Poor	-0.140	0.053	-0.099	-2.664	0.008*	0.426	2.345
Clinical Contact (Ref: Good)							
General	0.095	0.045	0.084	2.126	0.034*	0.376	2.661
Poor	0.162	0.052	0.134	3.142	0.002*	0.323	3.099
Self-directed learning	0.691	0.024	0.709	28.475	0.000*	0.949	1.053

R = 0.766, R² = 0.586, Adjusted R² = 0.578, F = 71.154, p < 0.001.

* = p < 0.05, * = p < 0.01, * = p < 0.001.

3. Discussion

3.1 General State of Medical Undergraduates' Professional Identity

Medical education is an important cornerstone of health care, and many high-quality medical talents are trained in the burgeoning medical education system. The professional identity of medical undergraduates is related to their professional development. It is of great educational and social significance to strengthen professional ideological education of medical undergraduates and improve their sense of professional identity.

Medical undergraduates' professional identity was at an upper medium level during online teaching. There are differences in professional identity between males and females. Medical undergraduates in different specialties have different sense of professional identity, which may be attributed to their different professional cognition and employment prospects. Junior students have a higher sense of professional identity than senior students. Xu Yujie and other researchers have reported similar results^[11]. Junior students may be full of yearning for future careers and curiosity about medical knowledge. With courses and learning tasks increase, senior students bear more pressure. In addition, increased social contact and influence of occupational environmental factors make senior students see the gap between reality and ideals, so the professional identity of medical undergraduates decreases with their grade grows.

This study also found that self-directed learning of medical undergraduates significantly predicted professional identity. In the process of independent learning, students can actively review and improve their learnings without relying on teachers^[12]. It has been shown that self-directed learning can promote medical students to improve their learning skills, sense of responsibility and self-confidence, so that medical students can adapt well to a dynamic clinical environment^[13]. Students with strong self-directed learning ability have higher learning motivation, self-efficacy^[14], and satisfaction with their specialty^[15], which can promote the formation of professional identity to some extent. Compared with traditional classroom teaching, web-based learning is more dependent on students' self-directed learning. At the same time, in the context of the 'Internet +' era, a new generation of learners is better at using the Internet and other means to search for information. Therefore, colleges and universities should pay attention to cultivating medical undergraduates to actively strengthen self-directed learning, encourage students to find information suitable for

themselves under appropriate guidance, thus improving their knowledge and skills, and promoting the formation of positive professional emotional attitude.

3.2 Influence of Teacher-Student Interaction on Professional Identity under Online Teaching Mode

According to the data analysis, most students believe that the interaction between teachers and students during online teaching has a positive impact on them. Serving as a predictor, teacher-student interaction plays a significant role in professional identity.

Compared with offline teaching, online teaching exerts its unique flexibility, which is manifested as flexible time, place and organization. On the other hand, during online teaching, more students are willing to take the initiative to ask questions due to the convenience of network platform. Increasing communication between teachers and students can make students gain a sense of identity and affirmation of their self-ability, stimulating their motivation to learn, and deepening their identity with the specialty they have studied.

Teachers play a role as ‘guiders’ in medical education, and teachers help support students’ career goals, beliefs, values, and motivations by ‘guiding’ and enhancing students’ self-confidence, discipline, resilience, and self-efficacy ^[16]. Professional identity is inversely proportional to job burnout and stress ^[17]. In the real medical environment, students may face problems such as long training cycles, difficulty in clinical skills, and contradictions between doctors and patients. Teachers’ correct guidance in a timely manner can help students enhance their resistance to crackdowns, and reduce occupational burnout ^[18]. Therefore, enhancing the interaction between teachers and students helps to cultivate medical undergraduates’ positive perception of medical profession and improve their professional emotions ^[19].

3.3 Influence of Clinical Exposure on Professional Identity under Online Teaching Mode

We found that online teaching has a significant disadvantage in clinical contact. Clinical contact, as one of the predictors, plays a significant role in professional identity.

Due to the limitation of learning through screens, online teaching often fails to meet the needs of students for practical clinical courses. Offline clinical practice is a necessary process for medical undergraduates to form professional identity. Contact, communication, and interview with patients in the actual clinical environment, all form the values and attitudes of medical undergraduates as junior doctors ^[20]. Besides, in offline clinical practice, doctors can timely guide students to integrate knowledge, making up for the limitations of lectures, so that students can better understand the knowledge they learned. This can stimulate students’ motivation for self-directed learning, promote students’ interest in medical specialties, and improve the professional literacy of medical undergraduates.

So far, many medical colleges’ curriculum arrangements have been segmented and tomographic ^[21], and have not balanced the relationship between curriculum and occupation, resulting in a lack of professional identity among most medical undergraduates. There should be coherence between basic education and clinical practice. Explicit and recessive professional literacy education should be integrated into medical curricula to improve the professional identity of medical undergraduates.

Therefore, schools can adjust the arrangement of medical curricula, utilize online curriculum resources before class to attract students’ interest in learning, and use advanced technological means to integrate professional education into theoretical teaching process in an innovative form. As for offline teaching, curriculum contents should be designed with higher practicality, being closer to the normal clinical career, so that students can gradually accept and be familiar with their career orientation.

4. Conclusions

In this study, we found that medical undergraduates' professional identity was at an upper-medium level during online teaching. Gender, grade, specialty, self-directed learning, online course resources, teacher-student interaction, and clinical contact are important factors affecting professional identity. Male students and junior students have higher professional identity. Self-directed learning, teacher-student interaction and clinical contact can positively predict professional identity. It is suggested to further improve the professional identity of medical undergraduates, strengthen the professional education of medical undergraduates, explore new paths of medical teaching methods, and construct new plans for medical personnel training.

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