



# The impact of student engagement on satisfaction with medical education in china: a supplementary perspective

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## Abstract

As one of the indicators reflecting student well-being in medical education practice, student satisfaction is no doubt an important topic. Instead of exploring student satisfaction from the perspectives of education quality and organizational factors, this study focused on student engagement to explore the impact of it on student satisfaction with medical education in China. Student engagement refers to students' actions, efforts and persistence, indicating both time and energy students invested in educationally purposeful activities, especially academic activities. The data used in this study came from the first national survey of clinical undergraduates—the China Medical Student Survey—in which 10,062 clinical medical undergraduates in 33 medical schools participated. We developed a model of medical student engagement and satisfaction and utilized descriptive statistics, ordered logit regression, and path analysis to describe the relationship between medical student engagement and satisfaction. In this study, student engagement was categorized into behavioral, emotional and cognitive dimensions. The findings showed that medical student satisfaction was relatively low and was significantly affected by student satisfaction, especially the behavioral engagement in clinical rotations and professional identity of emotional engagement. These findings could put a supplementary perspective on improving student satisfaction through student engagement, and offer notable implications for future research and practice.

**Keywords** Student satisfaction · Student engagement · Medical education · Medical students · China

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## Introduction

Student satisfaction is undoubtedly an important topic in medical education, especially for the medical student's well-being (Bishop et al., 2019). Well-being refers to people perceiving that their lives are going well (CDC 2018). Medical students face demanding academic workloads (Rogers et al., 2012). They are under great psychological strain and suffer more well-being crises than other college students of similar age (Dyrbye et al., 2005, 2006, 2019). The seriousness of the crisis has reached unprecedented levels in many countries lately, leading to a negative impact on students' academic performance and professionalism (Dyrbye et al., 2005, 2019). Moreover, according to prior studies, there is a prevalence of sexual dimorphism in medical learning environments and workplaces (Kristoffersson et al., 2018). Comparing to the male medical students, females are reported to be deficient in resilience, suffering higher levels of anxiety and distress, and have less psychological well-being (Amr et al., 2008; Dyrbye et al., 2006; Luna et al., 2020; Neufeld & Malin, 2019). As a subjective feeling, student satisfaction can directly reflect students' mental status. A decrease in student satisfaction would increase the risk of burnout (Dyrbye et al., 2009). This suggests that student satisfaction is an important indicator of student well-being in medical education (Bloodgood et al., 2009; Dyrbye et al., 2009; Wasson et al., 2016).

Students' perceptions of the educational programs have been highly valued by student-centered learning, and regarded as an essential element for educational quality control (ENQA 2015; UKSCQA 2017, 2018; USDE 2019). Student satisfaction has been taken into consideration in instruction evaluation since the early 1960s (Neumann, 1982). Moreover, student satisfaction is at the reaction level of learning outcomes according to Kirkpatrick's model (Bierer & Chen, 2010). It is an essential reflection of the student learning experience. Student satisfaction affects students' selection of and loyalty to institutions (Alves & Raposo, 2007; Brown & Mazzarol, 2009; Fornell et al., 1996; Kirkpatrick, 1996). Paying attention to student satisfaction can bring institutions considerable advantage, especially in a competitive education market (Alves & Raposo, 2007; Brown & Mazzarol, 2009).

Medical students are coproducers of the desired education and positive outcomes (Englander et al., 2020). For stakeholders, factors influencing student satisfaction should be the primary concern. The antecedents of student satisfaction in higher education include the university's image (Alves & Raposo, 2007; Brown & Mazzarol, 2009), resources, instructional effectiveness, service quality, environment, institutional identity (Elliott & Healy, 2001; Santini et al. 2017), students' achievement, gender, year of study, major, race, personality, etc. (Umbach and Porter 2002; Dyrbye et al., 2006; Amr et al., 2008; Rogers et al., 2012; Douglas et al., 2014; Adler et al., 2021). According to Stith et al. (1998), these factors can be categorized into personal, interpersonal and organizational domains. The above studies have addressed the issue from the perspective of organizational factors and student characteristics but paid limited attention to student behavior during the higher education process. However, students who engage in the education program by taking a greater interest, exhibiting higher motivation and stronger professional identity, and engaging in human interactions at a high level are likely to experience higher satisfaction (Monrouxe, 2010; Neumann, 1982). To guarantee the validity of student evaluations of instruction, researchers should verify the correlations between student satisfaction and objective external criteria (Neumann, 1982). Student engagement can be one such external criterion.

Moreover, student engagement theory states that the more time, effort, and energy students allocate to educationally purposeful activities, the higher achievements they will

reach (Astin, 1984; Carini et al., 2006; Kuh et al., 2008; Lam et al., 2012; Pascarella et al., 2010). Many educational interventions for medical students' well-being have indeed alleviated mental crises and improved student satisfaction by promoting student engagement (Wasson et al., 2016; Pathipati & Cassel, 2018; Bishop et al. 2019; Slavin, 2019). However, little research and practice focus exclusively on the effects that student engagement brings to student satisfaction (Wasson et al., 2016). Few educational interventions are designed purposely from the view of student engagement to improve student satisfaction (Pathipati & Cassel, 2018; Slavin, 2019).

In recent years, with the transformation of students' roles (Harden, 2018), students begin to become more engaged in educational programs. Student engagement, along with student satisfaction, plays a vital role in higher education quality assurance and accreditation of medical education worldwide (AMC 2012, 2015; ASPIRE 2012; GMC 2015; WFME 2015; UKSCQA 2017, 2018; USDE 2019; LCME 2020). On the one hand, there is a general consensus of the need be mindful of the student experience, satisfaction, and feedback and to promote student engagement, especially in practice (ASPIRE 2019). On the other hand, student engagement which is an essential part of the student experience affects the validity of student evaluations of instruction. Higher level of student engagement in the education program may lead to more accurate perceptions and ratings of education quality. It is reasonable to conclude that student engagement can be an external criterion supplementary to the study of student satisfaction and the relationship between them deserves constant attention.

## Student engagement

Interest in student engagement arose from the research on dropouts and school completion rates promotion (Reschly & Christenson, 2012). School completion is one measure of student success, and the content of student success is enriched (Kuh et al., 2007). There are not only traditional measures such as academic achievement but also personal development outcomes that benefit individuals and society, such as humanitarianism and practical competence, which suggests that the definition of student success extends from academic to social, behavioral, and emotional domains (Kuh et al., 2007; Reschly & Christenson, 2012; Skinner & Pitzer, 2012). Research on student engagement is driven by the desire to promote student success.

Student engagement refers to students' actions, efforts and persistence (Connell & Wellborn, 1991; Skinner & Belmont, 1993). It represents both time and energy students invest in educationally purposeful activities (Kuh, 2001), which include academics, student government, extracurricular activities, etc. (Reschly & Christenson, 2012). Students can build up academic and nonacademic achievements both inside and outside the classroom (Kuh et al., 1994). Student engagement is multidimensional, as are student success and school activities. This is not only reflected in various activities but also in the multidimensional construct. From the perspective of construct, student engagement entails behavioral, emotional and cognitive components (Fredericks et al. 2004). Cognitive and emotional dimensions can be integrated into psychological construct (Kahu, 2013). Academic or agentic engagement can be considered the fourth components of engagement (Appleton et al., 2006; Loch, 2013). Behavioral engagement involves active participation and interaction (Skinner & Belmont, 1993; Fredericks et al. 2004; Kahu, 2013). Emotional engagement refers to emotional reactions; it is characterized by energy and professional identity. Engaged students usually show positive emotions during ongoing actions, such as interest,

enthusiasm, absorption, belonging and feelings of identification (Appleton et al., 2006; Kahu, 2013; Schaufeli & Bakker, 2003; Skinner & Belmont, 1993). Cognitive engagement focuses on psychological investment, self-regulation and strategic learning; its indicators include self-efficacy, student concentration, positive coping in the face of failure, metacognition and learning strategies (Connell & Wellborn, 1991; Newmann et al., 1992; Christenson & Anderson, 2002; Furlong et al., 2003; Jimerson et al., 2003; Fredericks et al. 2004).

### **Educationally purposeful activities**

The first feature of student engagement is the amount of time, effort and energy students spend in their studies and other educationally purposeful activities (Kuh et al., 2007; McCormick et al., 2013). According to the “Seven Principles for Good Practice in Undergraduate Education” (Chickering & Gamson, 1987), educationally purposeful activities pertain to active learning, student-faculty contact, cooperation among students and feedback. Regarding medical student development, medical schools must ensure that students acquire the relevant knowledge and skills and spend a reasonable amount of time interacting with patients in the clinical settings (WFME 2015). This suggests that medical students need both curricular study and experiential learning. The clinical environment can be a site for both learning and training, i.e. applying knowledge and skills to practice (Chen et al., 2014). In addition, because of the growing trend toward scholarly concentration programs, medical education is gradually beginning to attach more importance to student engagement in research (Bierer and Chen 2010; WFME 2015; ASPIRE 2019).

In China, there are different types of higher medical education programs: five-year program to a bachelor’s degree, seven-year program to a master’s degree, eight-year program to a doctorate degree (Schwarz et al., 2004), and three-year program to an associate degree. It is a continuum including basic education, postgraduate education and continuing professional development. The outcomes of basic medical education can be grouped into four sets: science and scholarship, clinical practice, health and society, and professionalism. Hopefully graduates would possess essential foundations for medical practice and further their development through the curriculum, research projects, and clinical training (WCAM, 2016). Therefore, curricular study, clinical rotations and research are key educationally purposeful activities in medical education.

### **Student satisfaction**

Student success can be defined in terms of student satisfaction, engagement in educationally purposeful activities, academic achievement and the acquisition of desired knowledge, skills and competencies, and attainment of educational objectives (Kuh et al., 2007). Student satisfaction is an essential reflection of the quality of the student experience and one of the desired educational outcomes. Large-scale student surveys usually focus on students’ overall satisfaction with the quality of education and institutions, as well as specific evaluation of various aspects of the educational experience, such as the curriculum, practices, school management, student services and the learning environment (CSS 2016; NSSS 2019; AAMC 2020; NSS 2020). Students’ overall satisfaction reflects their holistic perception of their educational experience. Therefore, in this study we investigated students’ overall satisfaction with the quality of their education programs and, considering the importance of clinical education to medical students, paid further attention to student satisfaction with the quality of clinical education.

### Model for medical student engagement and satisfaction

This study hypothesized a conceptual model of medical student engagement and satisfaction (Fig. 1). Medical student engagement refers to medical students’ actions, efforts, and persistence in key educationally purposeful activities, including both student time and energy. From the perspective of activity types, there are various forms of student engagement (Peters et al., 2019), such as engagement in learning and research (Christie & Morris, 2021; Xerri et al., 2018), engagement in program evaluation, curriculum development and governance of education (Hsih et al., 2015; Luescher-Mamashela, 2013; Meeuwissen et al., 2019), and engagement in hobbies, social groups, cultural or religious activities and other extracurricular activities (Thompson et al., 2013). ASPIRE (A Schools Programme for International Recognition of Excellence in Education) awards recognize not only student engagement within but also outside the academic community (ASPIRE 2019). Since academic achievement is regarded as an essential component of student success and academic activities within education programs are closely watched in previous research, our model would exceptionally concentrate on medical student engagement in these activities.

In addition to activity types, student engagement can be classified into behavioral or psychological dimensions. In our taxonomy, medical student engagement comprises three dimensions, namely behavioral, emotional and cognitive engagement. And we observed behavioral engagement in three key educationally purposeful activities for medical students: curricular study, clinical rotations and research.

Behavioral engagement focused on active participation in curricular study, clinical rotations and research through the frequency of medical students’ behaviors, such as how often students ask or answer question actively in class, how often students engage in patient management, and whether students have scientific research experience. Emotional engagement is mainly concerned with medical students’ professional identity and energy for learning, represented by interest, long-term professional plans, enthusiasm and absorption. These dimensions of emotional engagement are measured by the level of student agreement on relevant rating scales, which contain items like having a clear goal and long-term plans for clinical medical study, can reach a state of absorption when learning, etc. Cognitive engagement concerned students’ self-efficacy, which refers to an individual’s judgment on whether he or she has the ability to achieve a certain behavior. According to social cognitive theory, people are sentient and purposive, and they act mindfully to make desired things happen (Bandura, 2001). In our model, medical students’ self-efficacy is measured by the ability to cope with difficulties and persuade others to agree with their opinions.

We investigated students’ overall satisfaction through their evaluation of education programs and clinical education. Satisfaction with clinical education was measured

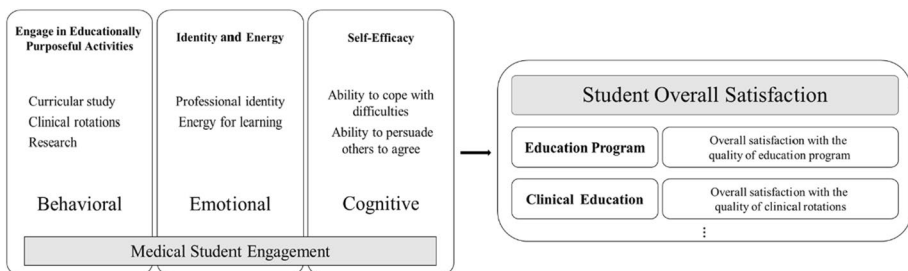


Fig. 1 The conceptual model of medical student engagement and satisfaction

by students' evaluation of clinical rotations and it is a separate concern. Because student engagement in the model refers to engagement in academic activities, we focused on students' evaluation of the teaching quality, although there are various domains that affect student satisfaction, such as student support services, physical environment, finances and others (Adler et al., 2021; Lee, 2010; Yusoff et al., 2015).

We want to explore medical student satisfaction and engagement. As female medical students suffer higher levels of distress than male medical students, we hypothesized that gender differences exist in student satisfaction between female and male students. We also explored whether there are gender differences in medical student engagement.

Regarding the factors influencing student satisfaction, we hypothesized that student engagement affects student satisfaction and controlled for student and family background characteristics. We also controlled for enrollment motivation (Wu et al., 2020). As colleges represent the organizational factors, we controlled for their fixed effects. Considering previous studies, we examined whether different dimensions of engagement would exert different effects on satisfaction, and whether there are influencing relationships among student engagement dimensions.

We aim to answer the following questions:

- What is the status of student satisfaction and student engagement among medical students? Are there gender differences in student satisfaction and student engagement?
- Does student engagement affect student satisfaction? If it does, what impact does student engagement have on student satisfaction? Are there different effects among different dimensions of student engagement?
- What are the relationships and directional pathways between student engagement and student satisfaction? What are the directional pathways among different dimensions of student engagement?

## Methods

### Data source and sample

The data for this study came from an existing survey, the China Medical Student Survey (CMSS) 2019. We selected the relevant variables from the CMSS 2019 dataset.

Commissioned by the Ministry of Education and the National Health Commission of the People's Republic of China, the National Center for Health Professions Education Development (NCHPED) was established on May 16, 2018. Then, at the suggestion of the NCHPED and Peking University Health Science Center, the Association for Health Professions Education Research in China (AHPERC) was organized by 20 medical schools in China on May 16, 2019. In 2019, the NCHPED and the AHPERC created the first national survey of clinical undergraduates, the China Medical Student Survey (CMSS). With the core objective of medical education quality improvement, the CMSS covered students' pre-college characteristics, undergraduate education experiences and outcomes, and paid attention to students' engagement, feelings and development. It remains the largest and most detailed survey of medical education in China to date.

The CMSS 2019 was delivered in June and July using the stratified random method to ensure the representativeness of the sample. Two rounds of sampling were conducted. The first round investigated 20 medical schools in the AHPERC. After statistical analysis of the

region, type and enrollment size of the schools in the first round, a second round of sampling was conducted. Finally, 33 medical schools offering undergraduate clinical medical education across 19 provinces were selected to participate in the CMSS in 2019. Before 2015, Chinese clinical medical students could choose a three-year program, five-year program, seven-year program and eight-year program. After communication with the sample schools, we obtained the number of clinical undergraduates of different medical education programs. All of the clinical medical students graduated in June 2019 from the seven-year, eight-year program or the five-year program of which the size of clinical medical undergraduates not exceed 500 were chosen. For undergraduates in a five-year program that exceed 500, a cluster sampling method was applied by class, and 50% of the undergraduates were studied. A total of 11,596 paper questionnaires were distributed with the help of sample school leaders, offices of educational administration and teachers. Participating students completed the questionnaires while guided by a teacher. All the sample schools and participants were aware of the survey and participated voluntarily. This study was exempt from ethical approval by the Institutional Review Board of Peking University because the survey was completely anonymously and did not include sensitive questions.

The geographical distribution shows, 11 institutions in the east (33.3%), 8 in the middle (24.2%), 9 in the west (27.3%) and 5 in municipalities (15.2%). The corresponding proportions at the national level in 2018 were 44.2%, 26.0%, 23.2%, and 6.6% (Liao et al., 2020a, 2020b). In comparison, the proportion of schools in the east was slightly lower, and that of the schools in municipalities was slightly higher. There were 20 medical schools in comprehensive universities (60.6%) and 13 in free-standing health professional institutions (39.4%). The proportion of the former was slightly higher than the national level (54.2%) (NCHPED 2020). In total, 10,062 responses were received, yielding a response rate of 86.77%. In reference to the 94,600 clinical medical undergraduates in China (Liao et al., 2020a, 2020b), the sample size was large. The regional distribution and types of sample medical schools were representative of the status quo for medical education in China.

## Variable measures

As a retrospective survey, CMSS 2019 investigated graduates' evaluation of their medical training, reflected by students' overall satisfaction with the quality of education program (ProSatis) and clinical rotations (CliSatis) through responses to one question. A 5-point Likert scale was adopted, where "5" represented the highest level of satisfaction (highly satisfied), and, at the opposite end of the range, "1" represented the lowest level (very dissatisfied), as shown in Table 1.

Student engagement was measured from behavioral, emotional and cognitive dimensions. For the behavioral dimension, behavioral engagement in curricular study (BeCs) and in clinical rotations (BeCli) were measured by behavioral frequency from 1 (never) to 5 (always) on a 5-point Likert scale. Both subtypes contained 4 items, and we used the mean scores of the 4 items to indicate each subtype. The measurement of behavioral engagement in research (BeRes) was whether medical students have ever engaged in research programs during their undergraduate education programs. This was dummy coded so that 0 = "No" and 1 = "Yes". Not all medical students had ever participated in research, but all of them had participated in the curricular study and clinical rotations. Therefore, we investigated yes/no questions for students' behavioral engagement in research programs whereas investigated frequencies for student behavioral engagement in curricular study and in clinical rotations (shown in Table 1). In addition, based on the clinical and professional skills

**Table 1** Variables measurement

Variables	Measurement
Student satisfaction	ProSatis 5-point Likert scale: 1 = very dissatisfied, 2 = dissatisfied, 3 = moderate satisfied, 4 = satisfied, 5 = highly satisfied;
Behavioral engagement	BeCs Behavioral frequency, 5-point Likert scale: 1 = never, 2 = rarely, 3 = sometimes, 4 = often, 5 = always; BeCli Research experience: 0 = No, 1 = Yes; BeRes
Emotional engagement	Iden Status description, 5-point Likert scale: 1 = completely disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = completely agree; Ener
Cognitive engagement	SE 0 = male, 1 = female
Gender	
NCEE score	Points, standardized in the regression analysis
Enrollment motivation	Status description, 5-point Likert scale: 1 = completely disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = completely agree
Rural/urban district	0 = urban area, 1 = rural area
Parental educational attainment	Years of education received
Parental vocations	International Socio-Economic Index of Occupational Status
Family economic status	Total annual income: 0 = Low (income equal to or lower than RMB100,000), 1 = High (income greater than RMB100,000)

*ProSatis* Education program satisfaction, *CliSatis* clinical education satisfaction, *BeCs* behavioral engagement in curricular study, *BeCli* behavioral engagement in clinical rotations, *Iden* professional identity, *Ener* energy for learning, *SE* self-efficacy



pointed out in the Basic Medical Education WFME Global Standards for Quality Improvement (WFME 2015) and medical students' main role in direct patient care and management during clerkships (Chen et al., 2014), behavioral engagement in clinical rotations was measured mainly by patient care.

For assessing emotional engagement and cognitive engagement, we used the section regarding student learning status in CMSS 2019. This section included professional identity (Iden), energy for learning (Ener) to reflect emotional engagement, and self-efficacy (SE) to reflect cognitive engagement. Students rated their level of agreement on a 5-point Likert scale from 1 (completely disagree) to 5 (completely agree). There were 3 items for professional identity, 2 items for energy for learning and 2 items for self-efficacy. Mean scores were used to imply each engagement subtype.

We considered students' background characteristics, including gender, National College Entrance Examination (NCEE) score, enrollment motivation and family factors, such as rural/urban district, parental educational attainment, parental vocations and family economic status. These variables were measured as follows: Gender was coded as 0="male" and 1="female." A perfect NCEE score of 750 points was standardized in the regression analysis. The enrollment motivation scale was adapted from the Academic Motivation Scale (Vallerand et al., 1992) to assess students' intrinsic motivation (IM) and extrinsic motivation (EM) according to agreement with items on a 5-point Likert scale ranging from 1 (completely disagree) to 5 (completely agree). Rural/urban district was coded as 0="urban area" and 1="rural area." Parental educational attainment was indicated by the father's and mother's years of education attained according to their education levels. Parental vocations were measured by the International Socio-Economic Index of Occupational Status (Ganzeboom et al., 1992). Family economic status was treated as a categorical variable with two possible values: 0="low" (total annual income equal to or lower than RMB100,000) and 1="high" (total annual income greater than RMB100,000). All of these variable measurements are shown in Table 1.

## Data analysis

The CMSS 2019 listed the items related to the constructs of our proposed model of medical student engagement and satisfaction. The engagement construct in this study was measured by the mean score of the relevant items, which were selected based on the current studies and our conceptual model. To assess the validity and reliability of each of the scales for student engagement, we performed exploratory factor analysis (EFA) and analyzed the Cronbach's alpha coefficients.

In order to explore the impact of student engagement on student satisfaction, a three-step process was followed. First, we used descriptive statistics to study the status of medical students' satisfaction and engagement. We performed Welch's t-tests to test whether there were gender differences in student satisfaction and engagement. Second, we used Pearson correlation analysis to explore the relationships between medical student satisfaction and engagement and the relationships between different dimensions of medical student engagement.

Third, we conducted an ordered logit regression analysis to evaluate the impact of student engagement on student satisfaction. The dependent variable was student satisfaction. Student education program satisfaction and clinical education satisfaction were analyzed. To reflect the differences in student satisfaction in detail, we used a Likert 5-point score directly, which means that the dependent variables were ordinal; hence, we chose the

ordered logit regression. We considered student engagement to be the independent variable and controlled for potential confounding factors, such as students' background characteristics and family background factors. We built a series of models to test the effects of different dimensions of student engagement on satisfaction separately and synergistically. Models 1 through 4 were built to explore the impact of student engagement on student education program satisfaction. Models 1 through 3 were used to test the influence of student behavioral engagement, emotional engagement and cognitive engagement respectively. Model 4 was used to test the influence of all three dimensions of student engagement. In this way, the impact of a single dimension of engagement was tested separately, and the changes and magnitude of the impact were determined when the three dimensions were considered together. Models 5 through 8 were built to explore the impact of student engagement on student clinical education satisfaction. Similarly, Models 5 through 7 tested student behavioral, emotional and cognitive engagement, respectively. Model 8 tested all the three dimensions of student engagement.

In addition, we employed path analysis to describe the relationships and directional pathways between student engagement and satisfaction and the relationships and directional pathways among different dimensions of student engagement. All the analyses were performed using STATA 14.0. Considering the sample size, the results of these tests were considered statistically significant when the two-tailed *p* value was <0.01.

## Results

### Descriptive analysis and factor analysis

Table 2 shows the sample distribution and descriptive analysis of certain variables in this study. The sample consisted of 4,518 males (44.9%) and 5,544 females (55.1%). Students in free-standing health professional institutions accounted for 45.4%, and the rest students attended medical schools within comprehensive universities. More than half of the students lived in urban areas, accounting for 64.5% (6,487) of the sample. Furthermore, on average, students' extrinsic motivation was slightly higher than their intrinsic motivation.

The summary results of the EFA for the items of student engagement and enrollment motivation scales are reported in Table 3. The constructs' reliability coefficients were all above 0.65 (from 0.691 to 0.865). Three factors were derived from the principal component analysis and each of them accounted for 68.9%, 71.3% and 79.3% of the variance for behavioral engagement in curricular study (BeCs), behavioral engagement in clinical rotations (BeCli) and self-efficacy (SE), respectively. Two factors that emerged for emotional engagement accounted for 79.3% of the variance. We named these two factors professional identity (Iden) and energy for learning (Ener). The enrollment motivation scale was also simplified into two factors that explained 69.6% of the variance, which were identified as intrinsic motivation (IM) and extrinsic motivation (EM).

### Status of medical students' satisfaction and engagement

The engagement scores reflect the level of the students' behavioral, emotional and cognitive investment in educationally purposeful activities. As shown in Table 4, the medical students' behavioral engagement in their clinical rotations was higher than that in their curricular studies. However, their satisfaction with clinical education was slightly lower than

**Table 2** Sample distribution and summary statistics of partial variables in the study (N = 10,062)

Variables	Sample size	Percent or Mean (SD)
Gender		
Male	4,518	44.9
Female	5,544	55.1
Institution types		
Free-standing health professional institutions	4,564	45.4
Medical schools in comprehensive universities	5,498	54.6
Home location		
Rural areas	3,575	35.5
Urban areas	6,487	64.5
NCEE score	10,062	588.4 (57.6)
Parental educational attainment		
Father	10,062	11.5 (4.06)
Mother	10,062	10.5 (4.32)
Parental vocations (ISEI)		
Father	10,062	38.2 (20.4)
Mother	10,062	36.2 (17.9)
Family economic status		
High level	3,432	34.1
Low level	6,630	65.9
Enrollment motivation		
IM	10,062	3.60 (0.92)
EM	10,062	3.68 (0.81)

*IM* Intrinsic motivation, *EM* extrinsic motivation, *ISEI* International Socio-Economic Index of Occupational Status; *Mean* mean score of each subtype items

that with education programs. More than one-half of the students reported having research experience during their undergraduate medical education. The students showed a relatively high level of professional identity and self-efficacy, but the energy put into learning was low.

As shown in Table 5, female students had significantly higher level of professional identity but lower levels of energy for learning, self-efficacy and extrinsic motivation than male students, whereas no significant differences were observed in student satisfaction and other subtypes of engagement.

## Relationship between medical student engagement and satisfaction

The correlations between the key variables and Pearson correlations are presented in Table 6. Student satisfaction with education programs and clinical education were significantly positively correlated with student behavioral engagement (BeCs, BeCli), emotional engagement (Iden, Ener) and cognitive engagement (SE). Student behavioral engagement in research was significantly associated with satisfaction in education program. Compared with other engagement dimensions, professional identity was the most relevant factor ( $r=0.387$ ,  $p<0.01$ ) for student education program satisfaction, while

**Table 3** Exploratory factor analysis of scales and the reliability coefficient

Scales	Survey items	Factor loading	Reliability coefficient
Behavioral engagement	Items	<b>BeCs</b>	0.849
	Make a presentation in class	0.851	
	Ask or answer questions in class actively	0.858	
	Active engage in group learning or classroom discussion	0.841	
	Consult faculty or peers after class	0.767	
	Items	<b>BeCli</b>	0.865
	Engage in clinical teaching rounds	0.814	
	Engage in case reporting	0.836	
	Engage in patient management	0.863	
	Emotional engagement	Items	<b>I<sub>den</sub></b>
I have interest in clinical medicine		0.761	
I have a clear goal and long-term plans for clinical medical study		0.712	
I hope the future career development will be closely related to clinical medicine		0.717	
Items		<b>E<sub>ner</sub></b>	0.714
I have enthusiasm for learning		0.603	
Cognitive engagement	I can reach a state of absorption when learning	0.570	
	Items	<b>SE</b>	0.739
	I can usually find ways to cope with difficulties in study	0.891	
Enrollment motivation	I have the ability to persuade others when they have different opinions in study	0.891	
	Items	<b>IM</b>	0.784
	I maintained good scores in related subjects in high school	0.717	
	I have a strong interest in medicine	0.861	
	I think being a doctor is respectable	0.656	
	I am confident I can succeed in the medicine field	0.774	
	Items	<b>EM</b>	0.691
	Being a doctor is stable employment	0.615	
	I anticipate that I will obtain a good salary in the future	0.601	
My family and I can use medical resources conveniently	0.703		
My family or teachers encourage or require me to choose medicine	0.800		

*BeCs* Behavioral engagement in curricular study, *BeCli* behavioral engagement in clinical rotations, *I<sub>den</sub>* professional identity, *E<sub>ner</sub>*=energy for learning, *SE* self-efficacy, *IM* intrinsic motivation, *EM* extrinsic motivation

behavioral engagement in clinical rotations was the most relevant factor ( $r=0.408$ ,  $p<0.01$ ) for clinical education satisfaction. Notably, the correlation coefficients between student engagement constructs were all significant ( $p<0.01$ ). Among the different dimensions and subtypes of engagement, professional identity was the most relevant factor for behavioral engagement in clinical rotations; self-efficacy was the most relevant one for behavioral engagement in curricular study and energy for learning.

**Table 4** Descriptive analysis of student engagement and satisfaction (N = 10,062)

Variables	Percent or Mean (SD)
Student engagement	
Behavioral engagement (BeCs)	3.27 (0.85)
Behavioral engagement (BeCli)	4.09 (0.81)
Behavioral engagement (BeRes)	
Yes	56.5
No	43.5
Emotional engagement (Iden)	3.93 (0.86)
Emotional engagement (Ener)	3.46 (0.89)
Cognitive engagement (SE)	3.61 (0.82)
Student satisfaction	
Education program satisfaction	3.91 (0.92)
Clinical education satisfaction	3.72 (1.06)

*BeCs* Behavioral engagement in curricular study, *BeCli* behavioral engagement in clinical rotations, *BeRes* behavioral engagement in research, *Iden* professional identity, *Ener* energy for learning, *SE* self-efficacy; *Mean* mean score of each subtype items

**Table 5** Results of Welch's t-tests

Variables	Female (5,544)		Male (4,518)		Difference	<i>t</i>	<i>p</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
BeCs	3.27	0.82	3.27	0.90	0.00	0.400	0.701
BeCli	4.10	0.80	4.09	0.82	0.01	- 0.800	0.411
Iden	3.95	0.85	3.90	0.88	0.05	- 3.000	0.003
Ener	3.43	0.87	3.49	0.92	- 0.06	3.050	0.003
SE	3.58	0.81	3.65	0.84	- 0.07	4.250	0.000
IM	3.61	0.89	3.58	0.95	0.03	- 1.650	0.101
EM	3.67	0.80	3.71	0.83	- 0.04	2.450	0.014
ProSatis	3.91	0.90	3.91	0.95	0.00	- 0.300	0.762
CliSatis	3.71	1.04	3.74	1.08	-0.03	1.300	0.197

*BeCs* Behavioral engagement in curricular study, *BeCli* behavioral engagement in clinical rotations, *Iden* professional identity, *Ener* energy for learning, *SE* self-efficacy, *IM* intrinsic motivation, *EM* extrinsic motivation, *ProSatis* education program satisfaction, *CliSatis* clinical education satisfaction, *M* mean score of each subtype items, *SD* standard deviation

### Impact of student engagement on student satisfaction

Table 7 shows the results of the ordered logit regression analysis of students' satisfaction with their education programs. We built four models to test the relationships between different dimensions of student engagement and education program satisfaction separately and synergistically. The models were successfully tested on the proportional odds assumption. Overall, student engagement was significantly positively associated with students' satisfaction with their education programs, except

**Table 6** Pearson correlations between the main variables

Variables	BeCs	BeCli	Iden	Ener	SE	ProSatis	CliSatis
(1) BeCs	1.000						
(2) BeCli	0.266*	1.000					
(3) Iden	0.468*	0.278*	1.000				
(4) Ener	0.501*	0.196*	0.590*	1.000			
(5) SE	0.505*	0.252*	0.599*	0.665*	1.000		
(6) ProSatis	0.328*	0.355*	0.387*	0.330*	0.355*	1.000	
(7) CliSatis	0.303*	0.408*	0.327*	0.320*	0.312*	0.481*	1.000
(8) BeRes- <i>p</i>	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.500
BeRes- <i>(t)</i>	(-18.3)	(-7.1)	(-10.5)	(-6.95)	(-9.85)	(-5.15)	(-0.65)

\*Shows significance at the 0.01 level

*BeCs* behavioral engagement in curricular study, *BeCli* behavioral engagement in clinical rotations, *Iden* professional identity, *Ener* energy for learning, *SE* self-efficacy, *ProSatis* education program satisfaction, *CliSatis* clinical education satisfaction, *BeRes* behavioral engagement in research

**Table 7** Results of the ordered logit regression analysis for student education program satisfaction (N=10,062)

Variables		Model 1	Model 2	Model 3	Model 4
Behavioral engagement	BeCs	0.53***(0.04)			0.26***(0.05)
	BeCli	0.71***(0.04)			0.62***(0.04)
	BeRes	-0.01(0.06)			-0.14*(0.05)
Emotional engagement	Iden		0.63***(0.03)		0.42***(0.04)
	Ener		0.43***(0.03)		0.23***(0.04)
Cognitive engagement	SE			0.75***(0.03)	0.24***(0.04)
Controlled Variables		YES	YES	YES	YES
Constant cut1		1.21***(0.18)	-0.06(0.19)	-0.57*(0.18)	2.06***(0.17)
Constant cut2		2.77***(0.18)	1.48***(0.20)	0.95***(0.19)	3.65***(0.17)
Constant cut3		4.85***(0.20)	3.53***(0.22)	2.96***(0.22)	5.80***(0.20)
Constant cut4		7.13***(0.20)	5.78***(0.22)	5.14***(0.21)	8.18***(0.20)
Pseudo R <sup>2</sup>		0.12	0.11	0.10	0.15
N		10,062	10,062	10,062	10,062
Df		12	11	10	15

Robust standard errors in parentheses and robust standard errors are clustered at the institution level; institution fixed effects, which are not reported; \*\*\* p<0.0001, \*\* p<0.001, \* p<0.01; mean VIF=1.74; BeCs=behavioral engagement in curricular study

*BeCli* behavioral engagement in clinical rotations, *BeRes* behavioral engagement in research, *Iden* professional identity, *Ener* energy for learning, *SE* self-efficacy; controlled variables: gender, standardized NCEE score, enrollment motivation, home location, parental education attainment, parental vocations, family economic status. *Note:* Assumption of proportionality of odds was approved

for behavioral engagement in research. In the behavioral dimension, the influence of behavioral engagement in clinical rotations ( $\beta=0.71$ ,  $p<0.0001$ ) on satisfaction was greater than that of behavioral engagement in curricular study ( $\beta=0.53$ ,  $p<0.0001$ ). In

the emotional dimension, professional identity ( $\beta=0.63$ ,  $p<0.0001$ ) was greater than energy for learning ( $\beta=0.43$ ,  $p<0.0001$ ). When all dimensions of student engagement were entered into the model, the impacts of self-efficacy, energy for learning, behavioral engagement in curricular study and professional identity on student satisfaction was largely decreased, the only exception to this trend was behavioral engagement in clinical rotations ( $\beta=0.62$ ,  $p<0.0001$ ). Behavioral engagement in clinical rotations was slightly reduced and was the most powerful factor in students' satisfaction with their education programs (Model 4, Table 7). Notably, the negative effect of behavioral engagement in research was larger and significant when the other engagement dimensions were entered.

Similarly, we built four models to explore the relationship between student engagement and satisfaction with clinical education (Table 8). The models were successfully tested on the proportional odds assumption. Overall, student engagement was significantly positively associated with students' satisfaction with clinical education, except for behavioral engagement in research. In the behavioral dimension, the influence of behavioral engagement in clinical rotations ( $\beta=1.02$ ,  $p<0.0001$ ) on satisfaction was much greater than that of behavioral engagement in curricular study ( $\beta=0.46$ ,  $p<0.0001$ ). When all dimensions of student engagement were tested, the impacts of emotional, cognitive and the other subtype of behavioral engagement were decreased except for behavioral engagement in clinical rotations. Behavioral engagement in clinical rotations was the most important factor ( $\beta=0.97$ ,  $p<0.0001$ ) in students' satisfaction with clinical education, followed by energy for learning ( $\beta=0.29$ ,  $p<0.0001$ ). The

**Table 8** Results of ordered logit regression analysis for student clinical education satisfaction (N = 10,062)

Variables		Model 5	Model 6	Model 7	Model 8
Behavioral engagement	BeCs	0.46*** (0.03)			0.26***(0.03)
	BeCli	1.02*** (0.04)			0.97***(0.04)
	BeRes	- 0.05 (0.05)			- 0.08(0.05)
Emotional engagement	Iden		0.45***(0.03)		0.22***(0.03)
	Ener		0.43***(0.04)		0.29***(0.04)
Cognitive engagement	SE			0.62*** (0.05)	0.11(0.05)
Controlled Variables		YES	YES	YES	YES
Constant cut1		3.13***(0.18)	0.66***(0.16)	0.24(0.16)	3.72***(0.18)
Constant cut2		4.33***(0.17)	1.80***(0.16)	1.37***(0.16)	4.92***(0.18)
Constant cut3		6.30***(0.20)	3.63***(0.19)	3.16***(0.19)	6.93***(0.22)
Constant cut4		8.23***(0.22)	5.40***(0.20)	4.89***(0.20)	8.90***(0.23)
Pseudo R <sup>2</sup>		0.12	0.08	0.07	0.14
N		10,062	10,062	10,062	10,062
Df		12	11	10	15

Robust standard errors in parentheses, and robust standard errors are clustered at the institution; institution fixed effects, which are not reported; \*\*\*  $p<0.0001$ , \*\*  $p<0.001$ , \*  $p<0.01$ ; mean VIF = 1.74. BeCs = behavioral engagement in curricular study

BeCli behavioral engagement in clinical rotations, BeRes behavioral engagement in research, Iden professional identity, Ener energy for learning, SE self-efficacy; controlled variables: gender, standardized NCEE score, enrollment motivation, home location, parental education attainment, parental vocations, family economic status. Note: Assumption of proportionality of odds was approved

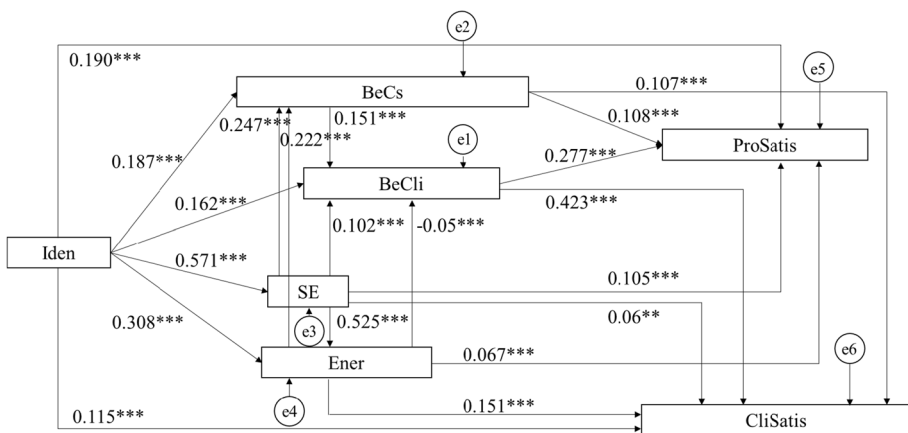
positive effect of self-efficacy was small and statistically insignificant, and behavioral engagement in research was not significant (Model 8, Table 8).

Comparing the two kinds of medical student satisfaction (Model 4, Model 8), female students ( $\beta = -0.16$ ,  $p < 0.0001$ ) showed significantly lower levels of satisfaction with their clinical education than male students. However, no significant gender difference was observed in students' satisfaction with their education programs. Student's extrinsic motivation positively affected student satisfaction in all eight models, whereas intrinsic motivation was not significant after emotional engagement was included. When all of the dimensions of student engagement were taken into consideration, the impact of extrinsic motivation remained significant ( $\beta = 0.30$ ,  $p < 0.0001$ , Model 4;  $\beta = 0.22$ ,  $p < 0.0001$ , Model 8).

### Path analysis of medical student engagement and satisfaction

According to the Pearson correlations and the results of ordered logit regression, there were significant relationships between student engagement constructs. Professional identity was an important variable because it was the most relevant factor for behavioral engagement in clinical rotations, and it had strong correlation with energy for learning and self-efficacy. The following model-fit indices were considered acceptable for the path modeling:  $\chi^2 = 4162$ ,  $p < 0.01$ , CFI = 0.953, RMSEA = 0.000, SRMR = 0.041.

Figure 2 shows the significant links between student engagement and satisfaction and the links among the five subtypes of student engagement. For student education program satisfaction, professional identity was the second most influential factor in addition to behavioral engagement in clinical rotations, and professional identity had the largest impact ( $\beta = 0.162$ ,  $p < 0.0001$ ) on behavioral engagement in clinical rotations among the five engagement subtypes. For student clinical education satisfaction, professional identity was the third most significant factor after to behavioral engagement in clinical rotations and energy for learning. Moreover, professional identity had a great influence ( $\beta = 0.308$ ,  $p < 0.0001$ ) on energy for learning in addition to self-efficacy ( $\beta = 0.525$ ,  $p < 0.0001$ ).



**Fig. 2** Path analysis of medical student engagement and satisfaction. *Iden* Professional identity, *BeCs* behavioral engagement in curricular study, *BeCli* behavioral engagement in clinical rotations, *SE* self-efficacy, *Ener* energy for learning, *ProSatis* education program satisfaction, *CliSatis* clinical education satisfaction; \*\*\* $p < 0.0001$ , \*\* $p < 0.001$ , \* $p < 0.01$ ; N = 10,062



Self-efficacy was also significantly influenced by professional identity ( $\beta=0.571$ ,  $p<0.0001$ ) and it had the greatest influence on behavioral engagement in curricular study ( $\beta=0.247$ ,  $p<0.0001$ ). All of results indicate that professional identity has a significant direct and indirect impact on medical student satisfaction.

Among the five subtypes of student engagement, professional identity significantly promoted behavioral engagement in clinical rotations, energy for learning, self-efficacy and behavioral engagement in curricular study. There were interactions among emotional, cognitive and behavioral engagement. Cognitive engagement (self-efficacy) and behavioral engagement (behavioral engagement in clinical rotations, behavioral engagement in curricular study) can be the mediators between emotional engagement (especially professional identity) and student satisfaction. Besides, student engagement promoted student satisfaction directly and indirectly, especially for emotional engagement (professional identity, energy for learning) and cognitive engagement (self-efficacy). In the behavioral dimension, behavioral engagement in curricular study significantly promoted behavioral engagement in clinical rotations.

## Discussion

As the CMSS 2019 was the first national survey of clinical undergraduates in China, its findings should, to a great extent, reflect the present situation of Chinese clinical medical students. Overall, the students' satisfaction with their medical education was not high, with mean scores for satisfaction with the education program and clinical education both below a satisfactory level (3 indicates a balance between satisfaction and dissatisfaction; 4 indicates satisfaction). Their satisfaction with clinical education was slightly lower than their satisfaction with the education program. Satisfaction represents students' overall educational experience. It reflects students' learning and living conditions during their education. Consistent with the findings of high prevalence of medical student well-being crises in many countries (Dyrbye et al., 2005, 2019; Slavin, 2019), this study observed medical students' low level of satisfaction with their programs and clinical education.

The high-level of professional identity in this study reveals the multiple professional roles that a qualified physician (doctor) need to play. In a highly professional occupation, doctors play a variety of roles, including professional, practitioner, scholar, scientist, communicator and manager (WFME 2015). Clinical skills, knowledge and attitudes are all essential. It is encouraging that the medical students possessed a high level of professional identity and were actively engaged in their clinical rotations. In addition to maintaining these achievements, medical education needs to help students improve their self-efficacy and the energy they invest in learning. Self-efficacy affects not only behavioral processes but also people's ability to cope with stress (Bandura, 2004). Furthermore, Klassen and Klassen (2018) illustrated that self-efficacy, as a topic gradually attracting more attention in medical education, provides underpinning for motivation, well-being and achievement. Learning energy, a positive emotion felt by students, can be characterized by enthusiasm and absorption, and is the opposite of burnout (Schaufeli & Bakker, 2003). Helping students increase their learning energy may help with reduction in burnout.

The results of this study suggest that student engagement should be taken into account when consider student well-being and satisfaction. For specific dimensions, behavioral engagement in clinical rotations is the factor with the most significant influence on medical students' satisfaction, especially in clinical education in China. Although this practical experience is mainly

in the Chinese context, it can still be used as a reference for medical education practice. Facing the challenge of balancing patient safety and offering students meaningful patient care activities (Yardley et al., 2013), medical schools provide resources and opportunities for students to practice their skills in limited and restricted ways in clinical learning environment (Chen et al., 2014). Finite opportunities to practice in clinical learning environment may explain why students with higher engagement in clinical rotations exhibited a higher level of satisfaction. Furthermore, as a critical component of medical education, students' engagement with and feelings about clinical education significantly affected their satisfaction with the entire education program. All of these reinforce the importance of student engagement in clinical rotations. According to Sastre et al. (2010), behavioral engagement could contribute to interpersonal communication, the perception of institutional students support and student satisfaction.

What's more, the direct and indirect effects of student emotional and cognitive engagement are also important, especially student professional identity. The path analysis showed that the students' professional identity affected their satisfaction directly and indirectly via self-efficacy, energy for learning and behavioral engagement. Professional identity can be considered as the underlying agent of self-efficacy and energy for learning. These findings are consistent with the social identity theory, which suggests that medical students' professional identity is the internalization of the characteristics, values and norms of the medical profession, resulting in an individual being motivated, acting, and feeling like a physician (Cruess et al., 2014). A high level of professional identity enables medical students to practice more confidently and more likely to be successful (Monrouxe, 2010). The students with identity dissonance experienced consequential emotional disruptions and stresses, such as uncertainty about their values and abilities, and may struggle with their roles as doctors, damaging student well-being (Monrouxe, 2010). Our analyses provided empirical support for identity theory; they complemented the research on professional identity and student well-being from the student satisfaction perspective on medical education in China.

Gender differences were detected in student satisfaction and engagement from the descriptive statistics. Female medical students showed significantly lower levels of satisfaction with their clinical education than males. Consistent with previous studies that females medical students are having less psychological well-being (Amr et al., 2008; Dyrbye et al., 2006), our research also provided evidence for the gender differences in the well-being crisis among medical students. Female medical students showed significantly lower levels of energy for learning, self-efficacy and extrinsic motivation than their male counterparts, despite demonstrating higher levels of professional identity. This may be a consequence of the current learning and workplace climates. These findings are in line with Martin's (2010) study of high school students and undergraduates, in which female students' levels of adaptive behavior (e.g., persistence) and adaptive cognition (e.g., self-efficacy) were significantly lower than those of their male counterparts. The lower extrinsic motivation of female students has also been found in prior studies (Kusurkar et al., 2013; Vansteenkiste et al., 2009), which is consistent with the greater sense of professional identity of female medical students in this study. Female students were less motivated by extrinsic factors when choosing clinical medicine, making them more likely to study clinical medicine and to becoming doctors.

## Conclusions and implications

Our study remedies the gap in current research of examining student satisfaction mainly from organizational and educational perspectives, and focusing on the relationship between student engagement and student competence. Instead, we developed a conceptual model for medical student engagement and satisfaction. Led by the hypotheses that student satisfaction is related to student engagement and that different dimensions of engagement have different effects on satisfaction, we used a series of statistical analysis methods to answer our research questions. We found that medical student satisfaction was relatively low and student engagement significantly affected student satisfaction, especially behavioral engagement in clinical rotations and professional identity of emotional engagement. Based on these findings, some implications for practice were offered. For example, medical educators should pay attention to students' feelings and experiences and design customized interventions (e.g., gender-specific plans). Student engagement can serve as a supplementary perspective in improving student satisfaction. Behavioral engagement in clinical rotations and emotional engagement, especially professional identity, are particularly important for medical students. Although it is challenging to expand student practice while striking a balance between patient safety and student development, clinical education should broaden hands-on opportunities.

## Limitations

We explored the relationship between student engagement and satisfaction. Given that the relationship between student achievement and student satisfaction contains complicated variables (e.g., bidirectional causality), the first limitation of this study is that student achievement was not included in the regression analysis. As a supplement, we controlled for the students' NCEE scores to avoid the potential influence of student ability. Second, potential self-report bias and measurement error in the survey may also affect the results. Students may tend to respond in socially desirable ways to make them look as good as possible (Donaldson & Grant-Vallone, 2002). In this survey, students may respond with pronounced engagement in curricular study, clinical rotations, and research and more emotional, cognitive engagement than actual situations warrant. This bias might make the level of medical student engagement overestimated and affect the internal validity. Future research could add relevant information from teachers, classmates and others to improve the accuracy of the student survey. Third, to improve the reliability of the conclusion that there are gender differences in student satisfaction and engagement from the descriptive statistics, regression analysis can be used in future studies. Last but not least, the findings of this study are more about the sample schools, although the stratified random method was used to ensure the sample's representativeness, more evidence is needed to generalize the research findings to a wider population.

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## Declarations

**Conflict of interest** The authors report no conflicts of interest. The authors alone are responsible for the content and writing of this article.

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