

# Trends in the study on medical education over the last 10 years, based on paper titles

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Medical education research subjects are incredibly diverse and have changed over time. This work in particular aims to compare and analyze research trends in medical education through the words used in the titles of these research papers. Academic Medicine (the journal of the Association of American Medical Colleges), Medical Teacher (the journal of the Association of Medical Education in Europe), the Korean Journal of Medical Education (KJME), and Korean Medical Education Review (KMER) were selected and analyzed for the purposes of this research. From 2009 to 2018, Academic Medicine and Medical Teacher published approximately 10 to 20 times more papers than the KJME and KMER. Frequently used words in these titles include "medical," "student," "education," and "learning." The words "clinical" and "learning" were used relatively often (7.80% to 13.66%) in Korean journals and Medical Teacher, but Academic Medicine used these phrases relatively less often (6.47% and 4.41%, respectively). Concern with such various topics as problem-based learning, team-based learning, program evaluations, burnout, e-learning, and digital indicates that Medical Teacher seems to primarily deal with teaching and learning methodologies, and Academic Medicine handles all aspects of medical education. The KJME and KMER did not cover all subjects, as they publish smaller papers. However, it is anticipated that research on new subjects, such as artificial intelligence in medical education, will occur in the near future.

**Keywords:** Learning; Medical education; Program evaluation; Teaching

## Introduction

Research subjects in medical education are incredibly diverse and have changed with the times. In the past 10 years, the annual conferences held by the Korean Society of Medical Education (KSME) had the following themes: In 2009 (the 25th Annual Conference), the main theme was "From Scholarly Medicine to Professional Competency"; "Medical Humanities" in 2010; "Medical Education: Reflection and Reform" in 2011; "Outcome-Based Medical Education" in 2012; "Challenges for Future Medical Education" in 2013; "Culture and Environment: Medical Education in Korea" in 2014; "Professorship" in 2015; "Students in Medical Education" in 2016; "Future Medical Education

and Artificial Intelligence" in 2017; and "A New Horizon for the Doctor Training System in Medical Education" in 2018. Each year, the KSME has decided upon a main theme to match the changes in the medical education and social environments [1].

Many medical education associations exist worldwide, such as the Association of American Medical Colleges (AAMC), the Association of Medical Education in Europe (AMEE), the Association of Medical Schools in Europe, the Asian Medical Education Association, the General Medical Council in the United Kingdom, the Canadian Association for Medical Education, and the Sociedad Española de Educación Médica [2]. These organizations also publish medical education journals, such as Academic Medicine, the journal of the AAMC; BMC Medical Education;

British Medical Journal; Educacion Medica (in Spanish); the International Journal of Medical Education; JMIR Medical Education; the Journal of Graduate Medical Education; the Journal of Interprofessional Care; MedEdPublish, the AMEE's open-access journal; Medical Education, the ASME's journal; Medical Teacher, another AMEE journal; Teaching and Learning in Medicine; and Research and Development in Medical Education.

In Korea, the KSME publishes the Korean Journal of Medical Education (KJME). Another medical education journal in Korea is the Korean Medical Education Review (KMER), published by the Department of Medical Education at Yonsei University.

This study aimed to compare and analyze trends in medical education research using the words from research paper titles.

## Medical education journals

For the purpose of this paper, two of the world's most prestigious journals—and especially in the United States and Europe—were chosen over global studies for an analysis: Academic Medicine, the journal of the AAMC, and Medical Teacher, the journal of the AMEE. The KJME and KMER, two Korean medical education journals, were chosen to examine studies in Korea.

From 2009 to 2018 (Table 1), the KJME published 410 papers, or an average of 41 papers per year, ranging from 30 to 50 per year [3]. The KMER published 205 papers, or an average of 20.5 papers a year, ranging from 9 to 30 per year [4]. Academic Medicine published 4,608 papers, or approximately 460 papers published annually, ranging from 376 to 563 per year [5]. Medical Teacher published 3,745 papers and an average of 374.5 papers a year, ranging from 325 to 442 per year [6]. Academic Medicine and Medical Teacher publish nearly 10 to 20 times more papers than those published in Korean journals.

## Frequencies of words used in the titles

A word cloud (RStudio; RStudio, Boston, MA, USA) uses large-sized words to represent words' increasing frequency [7]. When examining the frequencies of words in titles, the larger words in

the word cloud primarily involve such connecting words as “and,” “of,” “for,” “to,” “in,” “the,” and “on,” among others (data not shown); therefore, these words occur frequently. After removing these connections, the words “medical,” “student,” “health,” and “education” appeared as larger words. High-frequency words in titles include “medical,” “student,” “education,” and “learning” in the KJME; “medical,” “educational,” “study,” and “development” in the KMER; “medical,” “education,” “health,” and “medicine” in Academic Medicine; and “medical,” “education,” “student,” and “learning” in Medical Teacher (Fig. 1).

The word “medical” appeared in 248 of 410 papers (60.49%) in the KJME, 117 of 205 papers (57.07%) in the KMER, 1,405 of 4,608 (30.49%) papers in Academic Medicine, and 1,602 of 3,745 papers (42.78%) in Medical Teacher. The word “education” appeared 21.46%, 41.46%, 17.17%, and 21.66% of the time in the KJME, KMER, Academic Medicine, and Medical Teacher, respectively. The word “student” occurred 38.29% of the time in the KJME, 21.95% in the KMER, 11.00% in Academic Medicine, and 25.58% in Medical Teacher. These words appeared in the titles of the medical education journals because medical schools direct students' medical education (Tables 2, 3).

Most professors and staff in medical schools want to know how to teach students well, how students can learn well, the best way to administer a clinical education, how to improve students' clinical performance, what we must teach students to improve their clinical skill, how to rate students to check their level of education, and how to make beneficial programs for the students, among others. Therefore, the frequency of use for such words as “teaching,” “learning,” “clinical,” “evaluation,” “skill,” “curriculum,” and “program” were investigated (Tables 2, 3). The frequencies in the KJME were as follows: “learning” (13.66%), “clinical” (13.66%), “skill” (8.05%), “program” (7.07%), “evaluation” (5.85%), “teaching” (5.61%), and “curriculum” (3.41%). The frequencies of use in the KMER were “learning” (12.20%), “clinical” (7.80%), “skill” (2.44%), “program” (9.76%), “evaluation” (1.95%), “teaching” (7.80%), and “curriculum” (9.27%). The frequencies in Academic Medicine were “learning” (4.41%), “clinical” (6.47%), “skill” (2.04%), “program” (6.32%),

**Table 1.** Number of papers in each journal of medical education during last 10 years

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
KJME	50	42	41	43	41	40	41	45	30	37	410
KMER	9	12	13	16	25	23	23	27	30	27	205
Academic Medicine	419	559	391	376	453	442	417	455	533	563	4,608
Medical Teacher	325	327	334	442	383	386	396	340	388	424	3,745

KJME, Korean Journal of Medical Education; KMER, Korean Medical Education Review.

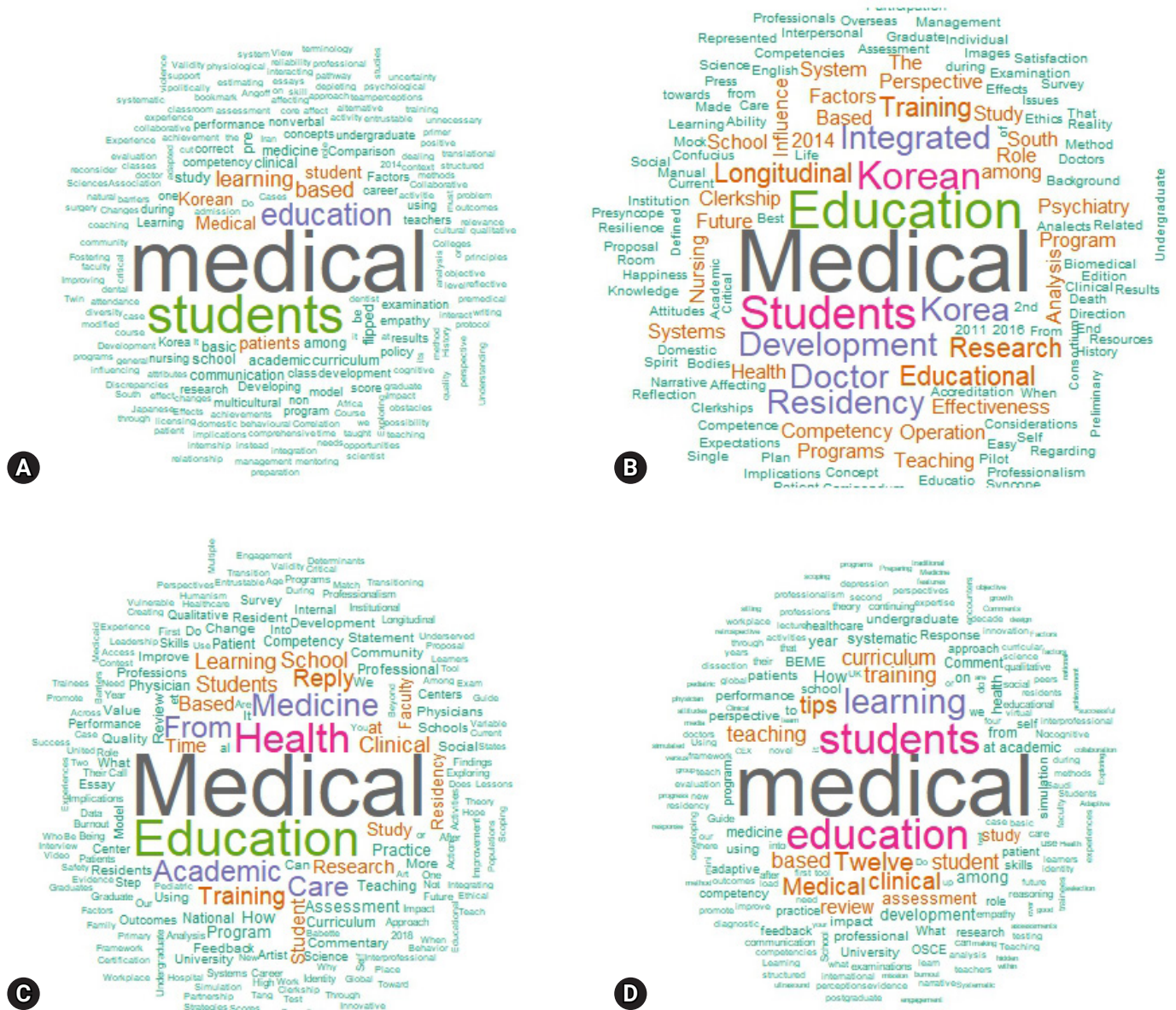


Fig. 1. Word cloud analysis with Rstudio for word frequencies after removing conductions in titles of papers in the KJME (A), KMER (B), Academic Medicine (C), and Medical Teacher (D) during the year 2018. KJME, Korean Journal of Medical Education; KMER, Korean Medical Education Review.

“evaluation” (1.80%), “teaching” (3.49%), and “curriculum” (1.50%). The frequencies in Medical Teacher were “learning” (11.56%), “clinical” (10.44%), “skill” (5.10%), “program” (5.18%), “evaluation” (2.91%), “teaching” (8.68%), and “curriculum” (4.97%). These results indicate that Korean journals and Medical Teacher have a relatively high proportion of the terms “clinical” and “learning” (7.80% to 13.66%), but Academic Medicine has a relatively low proportion (6.47% and 4.41%, respectively). Therefore, each journal has a slightly different direction to its pursuits.

### Changes in several research topics over 10 years

According to Kim et al. [8], problem-based learning (PBL) was introduced to Korean medical schools through a research paper that described the Harvard Medical School’s curriculum in 1992. Further, a PBL study group was organized under the KSME in 1995, with 15 medical schools applying PBL in their curriculum by 1999.

Team-based learning (TBL) is a widely used educational

**Table 2.** The word frequencies in the title of papers in the KJME and the KMER during year 2009 to 2018

Term	KJME		Term	KMER	
	No.	%		No.	%
Medical	248	60.49	Medical	117	57.07
Student	157	38.29	Education	85	41.46
Medical student	105	25.61	Medical education	53	25.85
Medical education	56	13.66	Student	45	21.95
Education	88	21.46	Medical student	24	11.71
Clinical	56	13.66	Clinical	16	7.80
Curriculum	14	3.41	Curriculum	19	9.27
Evaluation	24	5.85	Evaluation	4	1.95
Learning	56	13.66	Learning	25	12.20
Program	29	7.07	Program	20	9.76
Skill	33	8.05	Skill	5	2.44
Teaching	23	5.61	Teaching	16	7.80

KJME, Korean Journal of Medical Education; KMER, Korean Medical Education Review.

**Table 3.** The word frequencies in the title of papers in the Academic Medicine and the Medical Teacher during year 2009 to 2018

Term	Academic Medicine		Term	Medical Teacher	
	No.	%		No.	%
Medical	1,405	30.49	Medical	1,602	42.78
Education	791	17.17	Student	958	25.58
Student	507	11.00	Education	811	21.66
Medical education	481	10.44	Medical student	595	15.89
Medical student	326	7.07	Medical education	493	13.16
Clinical	298	6.47	Clinical	391	10.44
Curriculum	69	1.50	Curriculum	186	4.97
Evaluation	83	1.80	Evaluation	109	2.91
Learning	203	4.41	Learning	433	11.56
Program	291	6.32	Program	194	5.18
Skill	94	2.04	Skill	191	5.10
Teaching	161	3.49	Teaching	325	8.68

method that has been verified in medical education worldwide. It includes such factors as self-directed learning, teamwork, interpersonal communication, peer learning, and feedback, all of which healthcare professionals require. Significant evidence also exists that this method positively impacts academic achievement (e.g., summative assessments). Students prefer TBL over passive lectures or other types of small-group learning [9].

An educational program should be developed to both determine and outline what students can accomplish by the end of the course, and to note what they must learn to achieve target levels of knowledge and performance. Evaluations must then occur to ensure the program's successful implementation [9].

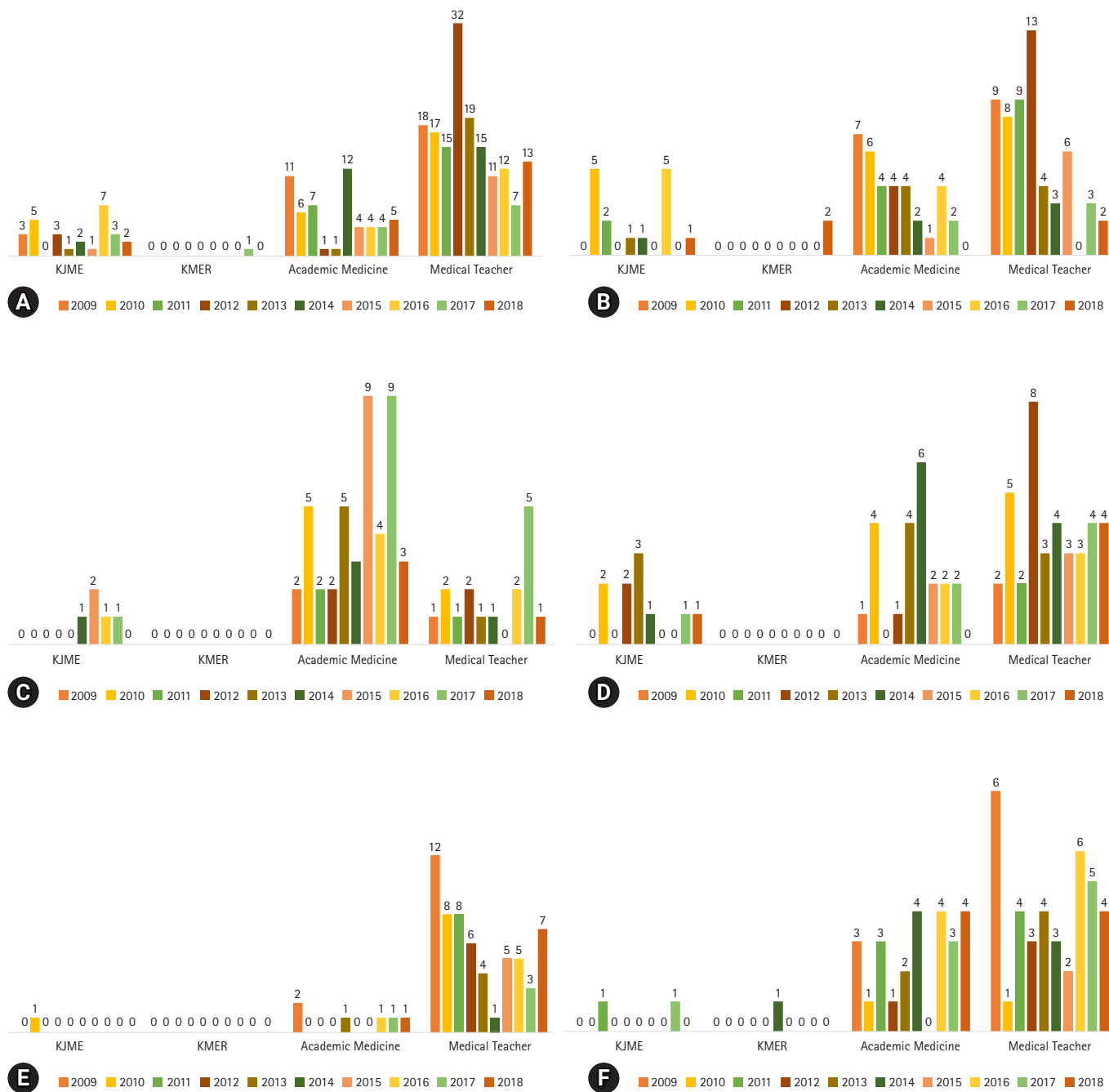
Medical students are highly aware of this academic burden; therefore, it is necessary to explore students' stressful experiences and adaptive endeavors as they progress in their degree programs

and the curricula change [10].

Digital devices—such as computers, smartphones, and tablets—are replacing such items as traditional printed books and paper notebooks. Interactive e-learning lectures are also used to supplement traditional lectures' shortcomings in many educational areas. Smartphones have become essential due to the development of mobile devices and wireless communication technologies. Interest has also recently increased in the 4th Industrial Revolution and artificial intelligence (AI), as reflected in the main theme of the KSME's 2017 annual conference, "Future Medical Education and Artificial Intelligence."

Research on these various topics—such as PBL, TBL, program evaluations, burnout, e-learning, and digital—were investigated over a 10-year period, from 2009 to 2018 (Fig. 2).

The concept of PBL was mentioned in 27 papers from the



**Fig. 2.** The number of papers showing MeSH Major Topics, such as "problem-based learning" (A), "program evaluation" (B), and "burnout" (C), and/or such topic words in titles of papers as "team-based learning" (D), "e-learning" (E), and "digital" (F) in the KJME, KMER, Academic Medicine, and Medical Teacher from 2009 to 2018. MeSH, Medical Subject Headings; KJME, Korean Journal of Medical Education; KMER, Korean Medical Education Review.

KJME, 1 from the KMER, 55 from Academic Medicine, and 159 from Medical Teacher. The KJME, Academic Medicine, and Medical Teacher covered PBL almost annually, but the KMER did not. Medical Teacher covered PBL more than Academic Medicine, although the former published fewer papers than the

latter. In 2012, Medical Teacher covered PBL in 32 papers, but Academic Medicine discussed PBL in only 1 paper.

While TBL was mentioned in 10 papers from the KJME, 22 from Academic Medicine, and 38 from Medical Teacher, the KMER did not cover TBL. Medical Teacher also covered TBL

more than Academic Medicine. In 2005, Academic Medicine first covered TBL, and Medical Teacher first covered PBL in 2006. Medical Teacher then covered PBL through 2 to 8 papers every year.

Program evaluations were mentioned in 15 papers from the KJME, 2 from the KMER, 34 from Academic Medicine, and 57 from Medical Teacher. The KJME, Academic Medicine, and Medical Teacher covered program evaluations nearly annually, but the KMER covered only two papers in 2018. Medical Teacher also covered program evaluations annually, ranging from 2 to 13 papers, although not in 2016.

Burnout was mentioned in 5 papers from the KJME, 44 from Academic Medicine, and 16 from Medical Teacher, while the KMER did not cover burnout. The KJME covered burnout the most recently, over 4 years from 2014 to 2017. Academic Medicine covered burnout more than Medical Teacher and did so annually, ranging from 2 to 9 papers.

e-Learning was mentioned often in Medical Teacher, but Academic Medicine and the KJME covered this topic only 6 and 1 times, respectively, while the KMER did not cover it. Medical Teacher covered 59 papers, with every year including 1 to 12 papers.

Digital was mentioned in 2 papers from the KJME, in 2011 and 2017; 1 from the KMER in 2014; 25 from Academic Medicine, and 40 from Medical Teacher. While Academic Medicine covered the digital topic every year, with 1 to 4 papers published each year—except in 2015— Medical Teacher first covered the digital topic annually, ranging from 1 to 8 papers published.

These results illustrate that Medical Teacher seems to primarily discuss teaching and learning methodologies, and Academic Medicine evenly addresses all areas of medical education. As the KJME and KMER publish 1/10 to 1/20 of the number of papers compared to Academic Medicine and Medical Teacher, it is difficult to study all subjects, such as PBL, TBL, program evaluation, burnout, e-learning, and digital. However, as the KJME published research on burnout in the most recent 4 years, it is expected that research on new subjects, such as AI in medical education, will occur in the near future.

## Conclusion

For the 10-year period from 2009 to 2018, Academic Medicine and Medical Teacher published approximately 10 to 20 times more papers compared to the number of papers published in Korean journals. Frequently used words in these titles include “medical,” “student,” “education,” and “learning,” seemingly because medical schools direct medical students’ education. The frequency of use for such words as “teaching,” “learning,” “clinical,” “eval-

uation,” “skill,” “curriculum,” and “program” were investigated; the results reveal that the Korean journals and Medical Teacher have relatively high frequency of “clinical” and “learning” (7.80% to 13.66%), but Academic Medicine has a relatively low frequency (6.47% and 4.41%, respectively). Therefore, each journal has a slightly different direction in its pursuits.

Researchers investigated various topics, such as PBL, TBL, program evaluation, burnout, e-learning, and digital, over the 10-year period from 2009 to 2018. Medical Teacher primarily addressed teaching and learning methodologies, while Academic Medicine handled all areas of medical education.

As the KJME and KMER have 1/10 to 1/20 of the number of papers in Academic Medicine and Medical Teacher, it is difficult to study all subjects. However, it is anticipated that new subjects—such as AI in medical education—will be researched in the near future.

## Conflicts of interest

No potential conflicts of interest relevant to this article was reported.

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