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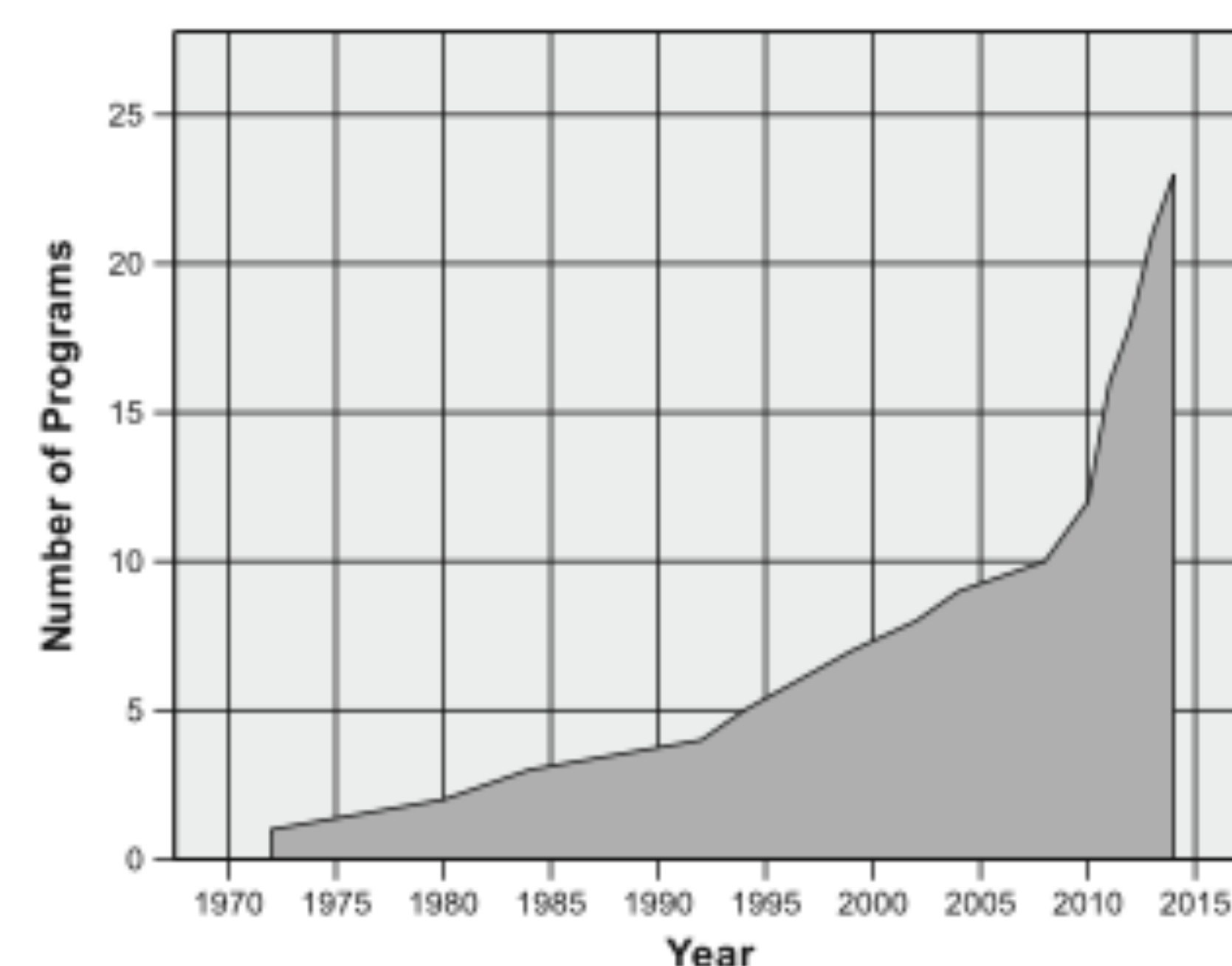
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## Abstract

In light of the recent curricular renewal process at UCSD School of Medicine (SOM), there was a need to pilot several educational innovations that align with the changes being discussed for the preclerkship curriculum. These innovations include incorporation of academic coaching, professional identity formation (PIF), health systems science (HSS), near-peer tutoring, active learning pedagogies such as team-based learning (TBL), and a programmatic assessment framework that incorporates several different inputs to track student progress and give feedback. The UCSD summer prematriculation course (PMC), Core Topics in Biomedical Sciences (CTBS), was the ideal setting to pilot these innovations. The redesigned course was highly rated by the students in its first year: 4.81/5 for course excellence, 4.94/5 for course organization, and 4.88/5 for facilitation of learning. The programmatic assessment structure and TBL were the highest rated of the innovations, with student ratings of 4.94/5 and 4.75/5, respectively. The programmatic assessment data was utilized in curricular renewal planning meetings to inform future changes to the assessment structure for the SOM.

## Introduction

Since 2010, there has been a sharp rise in PMCs (see Fig 1)<sup>1</sup>. Between 2012-2014, a survey of medical schools that belong to the Association of American Medical Colleges and American Association of Colleges of Osteopathic Medicine found thirty-one medical schools that offered PMCs. The mean course length was approximately four weeks, with 75% of the course content focused on biomedical sciences. The primary goal listed by over 95% of the PMCs was to improve student academic performance. Between 2013-2015, we examined our previous structured PMC at UCSD and found that it resulted in an average increase in academic performance by 0.3 standard deviations and may have prevented a student from falling below the pass line in eleven instances<sup>2</sup>. With our newly redesigned PMC, we hoped to improve upon the increase in academic performance observed previously. Additionally, we wanted to promote student benefits of engaging with academic coaching, near-peer tutoring, and development of PIF as well as cultivating an appreciation of HSS as the third pillar of health professions education.



**Fig. 1** The upward trend in prevalence of PMCs in the USA since 1970. Based on the data collected here, we observed an approximate 52.2% increase in PMCs since 2010. Out of a total of 23 programs who responded to question #3, 13 were created since 2010. The most common response to question #3 "What year was your program established?" was 2011 (17.4%,  $N = 4$ ). The second most common response was 2013 (13.0%,  $N = 3$ )

## Materials and Methods

Core Topics of Biomedical Sciences (CTBS) is a prematriculation course (PMC) offered to all incoming first-year medical students and second-year pharmacy students. It is approximately seven weeks and has been offered for decades. In the summer of 2022, the CTBS course had 21 medical students and 5 pharmacy students enrolled and in 2023 the CTBS course had 23 medical students enrolled.

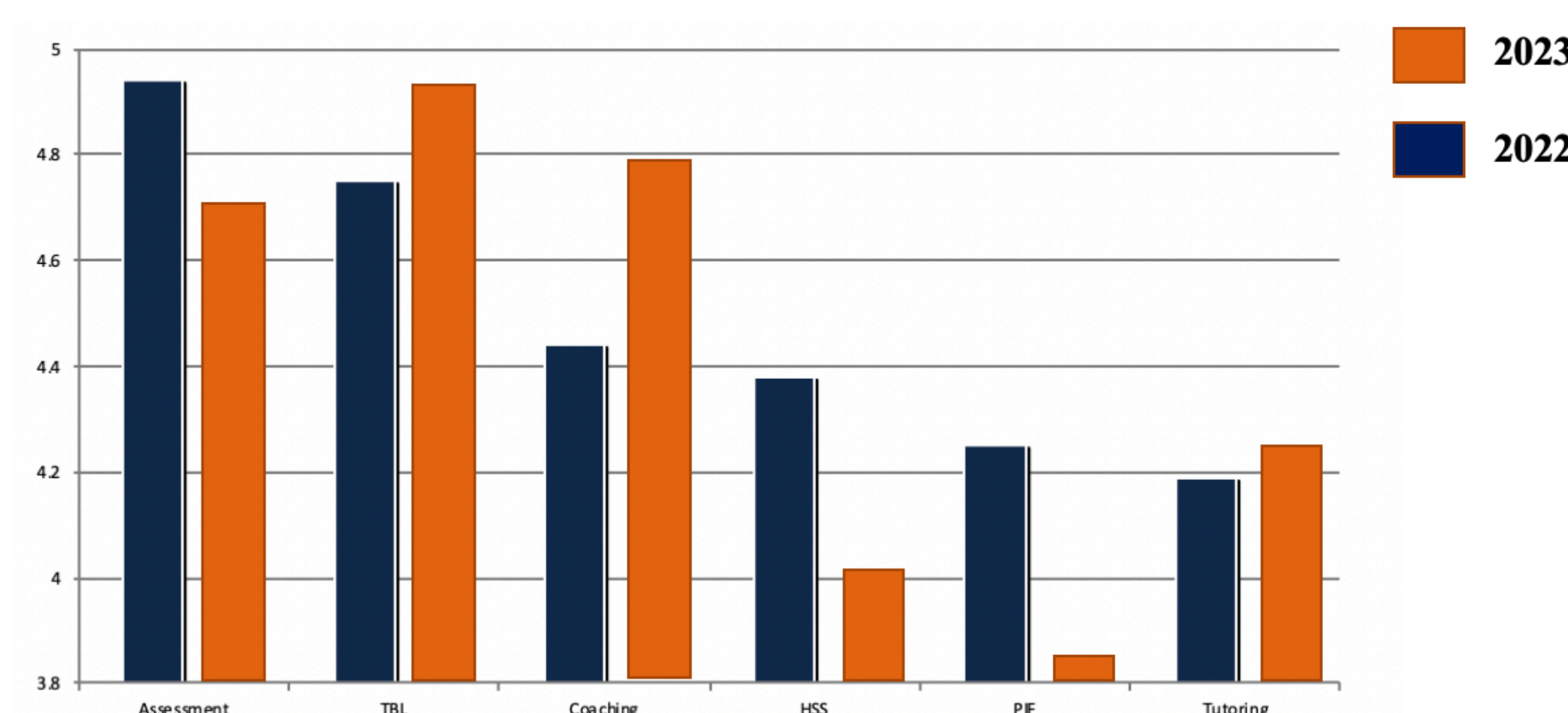
The CTBS course was offered virtually via Zoom to expand accessibility to the students. The course was significantly modified to include several innovations. For example, there were no live lectures and trademarked team-based learning (TBL) was the active learning pedagogy used for class learning time. Each week was dedicated to a discrete biomedical science content area. The areas included cell signaling/ homeostasis, neurology/neuroscience, autonomic nervous system, cardiovascular system, renal system, immunology, and multi-system integration. Each week, Monday was a dedicated study day and students had two days of TBL sessions followed by a quiz every Thursday. Every Friday, students engaged with a health professional to discuss HSS. After every class session, students were asked to write self-reflections. Each week, students had a scheduled meeting with an academic coach who was a senior medical student.

In addition, the academic coaches and CTBS students took a professional identity formation essay (PIE) which were read by scholars in the area of PIF and received feedback.

CTBS also had several inputs to the grade using a programmatic assessment framework. There were five weekly quizzes worth in total 25% of the grade that used multiple-choice and open-ended questions in addition to seven TBLs (21% of grade), approximately seven coaching sessions (5% of grade), self-reflections (10% of grade), HSS project (5% of grade), and a cumulative final exam (34% of grade).

## Results

For the first two years of implementation, the evaluation question about facilitation of learning was rated 4.88/5 and 4.95/5 compared to an average of 4.42/5 for 2020 and 2021. The IRAT class mean was 58.4% (SD = 10.9%) and performed significantly better on the TRATs with a mean of 95.5% (SD = 2.3%). The class showed significant improvement from the IRATs to the higher-stakes end of week quizzes, with mean scores increasing to 81.4% (SD = 8.5%).



**Fig 2.** CTBS course evaluations of the specific innovations: Assessment, team-based learning (TBL), Coaching, health systems science (HSS), professional identity formation (PIF), and tutoring. The CTBS students were asked to rate each element on level of satisfaction on a 5-point scale ranging from 1= Very Dissatisfied to 5 = Very Satisfied (2022:  $N = 16$ ; response rate = 62%; 2023:  $N = 19$ ; response rate = 82%).

## Student Evaluation Comments on Team-Based Learning (TBL)

### Student Comment #1

"This was where I did the most "active" learning. I appreciated the opportunity to do the problems first so I could identify what I already knew and what I struggled on. I also liked that immediately afterwards, I could meet with my teammates to go over the questions and share our answers and thoughts."

### Student Comment #2

"TBLs were the BEST part! They helped reinforce everything we learned and even learn more! They challenged us to think more critically regarding all the topics and I am very happy we were able to do it in a team. I learned a lot from my teammates because they had different perspectives and were able to explain things in their way. Sometimes there wouldn't be much engagement from anyone, but it was all very helpful overall and I am glad the course was organized this way. The application exercise was also very challenging which was great"

### Student Comment #3

"The component of the class created opportunity to make new relationships, improve communication and teamwork in a medical setting, explore curiosity with peers, learn from peers, and work through difficult concepts through deliberation and stimulating discussions. I came into this component of the course skeptical because of previous experiences with group learning in undergrad. However, I quickly realized that all of my teammates cared as much as I did and were brilliant - a recipe for great work. I would go as far as to say this was the most effective curricular component of the class."

### Student Comment #4

"I really enjoyed meeting my future classmates and getting to know them through this team-building activity. I never realized how much I can learn from others, and it was nice to hear from different perspectives and receive advice on certain things. I also felt that I wasn't alone and that we worked together to tackle these difficult problems. Overall, it was an immersive experience that emphasized the importance of collaboration."

### Student Comment #5

"I adamantly believe a great portion of my learning came from being able to participate in the team based learning components that were integrated into the TRAT format. By first attempting IRATs independently I was primed to learn the concepts and collaborate to reinforce knowledge."

**Fig. 3.** Selected student evaluation comments regarding specific curricular innovations.

## Conclusion

Overall, the changes to our summer PMC were well received as evidenced by high course evaluations. Students embraced the challenge of solving items of high difficulty in a team setting if given adequate time to first think through the problem with zero-stakes and encouraged to use and share their learning resources with each other. The success of our PMC led to the adoption of TBL in our pre-clerkship curriculum courses as well as the quarterly Progress Week active learning session.

## References

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