

Solidifying our commitment to boards, i.e., our Bread & Butter!

At the United States Military Academy, using chalkboards is a time-honored cherished tradition and a key pedagogical component of the mathematics curriculum. Active learning by sending cadets to chalkboards to solve problems aligns well with the TRU Framework that we are incorporating into our lesson planning. While some courses still follow historic board-related procedures, such as writing names on the board or briefing using a pointer, these practices are not mandatory in our department. Instructors are encouraged to experiment with the use of boards in a way that is aligned with the TRU Framework—focusing their activity on content; cognitive demand; access; agency, ownership, identity; and/or formative assessment—to enhance learning. **This will be a primary focus of mine as I conduct classroom visits this AY.**

Take Boards! Why?

Board work allows cadets to individually or collaboratively engage with tough concepts, practice fundamentals, and/or explore different methods without constraint in a safe space; and it can and should be enjoyable! It is central to our pedagogical approach and is enabled by class sizes less than 18. By working and then presenting their work on the board cadets are afforded opportunities to articulate their thought processes, explain their reasoning, engage in meaningful discussions, and receive instructor feedback. The success of board work depends significantly on the instructor's choice of problems and their attitude, i.e., packaging matters. Instructors should select problems that promote 'productive struggle,' and encourage deep thinking across multiple dimensions such as graphically, analytically, conceptually, and/or numerically with and without technology and problem-solving while helping cadets develop resilience and critical thinking skills. **If problems are not carefully chosen, cadets may resort to plug-and-chug approaches,** applying formulas mechanically without grasping the underlying concepts or alternately may give up and do nothing if too difficult. To prevent this, instructors should design problems that require exploration of fundamental principles and avoid providing premature answers or directing a single solution approach. Attempting to guide cadets through their reasoning processes, fosters deeper engagement with the material. Effective teaching involves offering timely, constructive feedback and encouraging peer interactions, while allowing cadets time to think and explore different approaches.

If an instructor chooses to have a cadet brief their board work, clear guidelines on what to include in their presentations—such as methods, rationale, and analysis—ensure that discussions remain focused on key concepts and enhance collaborative problem-solving, **rather than simply narrating calculations.** **Something to consider:** problem solving on boards should be a little messy if you internalize the above discussion; you may also agree with me when I say 'learning is UGLY'. This is ok in the classroom, but I think you need to realize messy boards are hard to brief to a class. If you want cadets to brief the class, consider providing them a second board to neatly and concisely articulate key concepts, i.e., give them two boards, one to problem solve and one to brief (sometimes they have to try a couple things before they know what works, when they figure that out, then they can write it up nice!) After a cadet presents, the instructor should look to facilitate discussions where peers ask questions or suggest alternative methods. This feedback loop is crucial for refining cadet understanding and developing skills in giving and receiving constructive comments. Involving the class in discussions about board work positively impacts classroom culture by creating an environment where mistakes are seen as opportunities for growth. **Emphasizing that initial attempts may be messy and focusing on the refinement process helps build resilience and positive learning attitudes.** It also reinforces character traits such as perseverance, adaptability, and a commitment to continuous improvement—qualities essential for effective military leadership.

Because these activities take time and classes are limited to 55 or 75 minutes in which cadets do not have time to loiter after class, careful thought should be given to what cadets can walk away from board work with like a receipt of their effort. Boardsheets, notes outlines, or online handouts are departmental norms to address this, but not mandatory.

The Board Problem Challenge!

Each month (aligned with coffee calls) I'd like to have a contest to be voted on, where we showcase examples of cadet board work in a collage of sorts (clearly we seek examples that demonstrate excellence; I'd encourage every instructor to personally engage cadets who demonstrate examples to the contrary). Prior to each coffee call, we will publish a collection plan, but I'd ask everyone to take pictures of awesome cadet board work. The Department will vote on the submissions at coffee call and the owner of the most awesome picture will get my parking pass. Ultimately, I seek to submit a short article with the winners to highlight our pedagogical commitment to showcase this time-proven technique, i.e., our Bread & Butter at the end of the AY to an MAA journal (maybe the A/S1 and DACs will also serve as co-authors)!