

Building STEM Momentum: Does Starting at a Two Year College Have an Impact?

As efforts continue toward increasing completion rates in STEM fields in response to a national spotlight on the issue—especially for underrepresented students—the focus is on community colleges as a viable entryway to four-year degrees. Community colleges provide a cost-effective option to postsecondary education and as such are in a unique position to increase access to undergraduate STEM education, leading to a more diverse STEM workforce. Therefore, it is important to understand what effect this pathway has on a student's ability to obtain a four-year degree. In addition, how does "STEM momentum", a new concept that builds on academic momentum and includes academic behaviors and effort put forth by the student in early STEM coursework, factor into student success in obtaining four-year degrees?

Examining a nationally representative dataset and supplement (BPS:04/09 and PETS:09), Wang (2015) examined the impact of beginning at a community college on four-year degree completion in STEM. In addition, she explored the extent to which STEM momentum was related to four-year degree completion in STEM and whether starting at a community college impacted this STEM momentum. The sample was restricted to students beginning their postsecondary studies at public two- and four-year institutions, as well as those who had taken at least one STEM course during their first year in college, which was one indicator that the student planned to study in a STEM field. In addition, this criteria was defined as students who had chosen a STEM major—focusing on programs and courses commonly available at both community college and four-year institutions.

Defining how to measure STEM momentum is a challenge for researchers. Therefore, premises must be laid out explicitly so that any results generated within a given study can be clearly understood. In this study, three STEM momentum measures were carefully chosen as indicators of early STEM momentum that may have an impact on student outcomes:

- 1) Total attempted credit hours—how many credits in STEM did a student enroll in during their first term? This indicates a measure of "quantity" of early efforts.
- 2) How many quality points students received from their STEM courses during the first term. This is an indicator of speed, or velocity at which students successfully progress toward their coursework.
- 3) Whether students enrolled in STEM during the first summer term following their postsecondary enrollment.

Once the early STEM momentum variables were chosen, research was conducted to establish a control group, which included public four-year college students that could be used as a simulation of the opposite condition of the the public two-year student group whose data was obtained. This propensity score matching (PSM) approach allows researchers to create a model control group when it's not feasible to have a randomized study. Here, students' decisions related to attending a two-year or four-year institution could not be assigned randomly in order to inform the study. Once PSM was complete, path analysis was conducted to create a representation of the direct and indirect effects of beginning at a community college, and also what the impact of beginning at a community college is on STEM momentum.

Results indicate that, within this study sample, students who started at a community college were less likely to obtain a four-year degree in STEM. However, when additional nuances were added to the picture, things looked different. Most interestingly, when momentum was measured by first semester

quality points, STEM outcomes for two-year students improved. Therefore, even though students who started at a two-year college were less likely to obtain a four-year degree in STEM than their counterparts who started at a four-year overall, this effect was reduced and even eliminated when students collected quality points in STEM—that is to say, when students find success in their STEM coursework. To take this a step further, when self-selection is accounted for, beginning at a community college actually improves STEM momentum by boosting the STEM quality points, indicating that community colleges are a good choice for students who might otherwise not attempt STEM coursework.

Hard work and commitment to learning are essential for success in STEM—the rigor of STEM curricula demand that much time and effort be put into mastering content knowledge in these fields. Students who begin at community colleges do so for many reasons, one of which is that it is a cost-effective option with flexibility, making it especially appealing to students traditionally underrepresented in STEM. Reviewing early academic behaviors that students exhibit and studying their early efforts or "STEM momentum" can provide valuable insight related to where resources might be directed, in particular, toward programs that encourage students to invest the time and effort needed to be successful. Students need to complete a substantial number of STEM courses and perform well in them to get on the right trajectory to success. In light of these findings, efforts should be made by community colleges to:

- Emphasize guidance of students' early academic behaviors and choices—getting those STEM quantity and quality points counts.
- Review student pathways beyond early experiences to reveal viable long-term STEM pathways as well as leaky spots in the pipeline.
- When possible, introduce early authentic research experiences to engage students right away with content that connects academic learning to applications in STEM that might inspire them.

References and Works Cited:

Wang, X. (2015). Pathway to a baccalaureate degree in STEM fields: Are community colleges a viable route and does early STEM momentum matter? *Educational Evaluation and Policy Analysis*, 37(3), 376-393. doi:10.3102/0162373714552561