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Untypical Undergraduate Research: Player Motion Analysis in Sports

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There is significant concern about the degree of attrition in STEM disciplines from the start of K-12 through to the end of higher education, and the analysis of the 'leaky pipeline' from the various institutions has identified a critical decline - which may be as high as 60 percent - between the fraction of students who identify as having an interest in a science or engineering major at the start of college/university, and the fraction of students who ultimately graduate with a STEM degree. It has been shown that this decline is even more dramatic for women and underrepresented minorities (Blickenstaff 2005, Metcalf 2010). One intervention which has been proven to be effective for retention of potential STEM students is early research experience, particularly if it facilitates the students' integration into a STEM learning community (Graham et al. 2013, Toven-Lindsey et al. 2015). In other words, to retain students in STEM majors, we would like to encourage them to 'think of themselves as scientists', and simultaneously promote supportive peer networks. The University of Denver (DU) already has a strong undergraduate research program. However, while the current program provides valuable training for many students, it likely comes too late to be effective for student retention in STEM, because it primarily serves older students who have already finished the basic coursework in their discipline; within physics, we know that the introductory physics courses already serve as gatekeeper courses that cause many gifted but 'non-typical' students to lose interest in pursuing a STEM major (Tobias 1990). To address this issue, my lab is developing a small research spinoff program in which we apply spatiotemporal motion analysis to the motion trajectories of players in sports, using video recordings of DU Pioneer hockey games. This project aims to fulfill a dual purpose: The research is framed in a way that we think is attractive and accessible for beginning students who have not yet finished the basic physics course sequence, and we hope to use it to attract untypical and retain undecided students in physics. Secondly, since mathematical techniques for trajectory analysis are independent of scale, we hope to harness the creativity and analytical intuition of undergraduates to simultaneously benefit our core biophysical research program.