

BIOMECHANICS WITHOUT BORDERS: TEACHING BIOMECHANICS IN BRAZIL AND SOUTH AFRICA

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Conflict of interest statement

Authors declare no conflict of interest in regard to the content of this article.

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INTRODUCTION

The 2020 SARS-CoV-2 pandemic has necessitated alternative means of communicating/sharing content between *colleagues* (e.g. webinars) and *students* (e.g. digital classrooms). Consequently, various online formats have been explored as a safe and effective way to facilitate interactions between academic teaching staff and students. In addition to the important role that online events have played during the pandemic, it also presents an opportunity to connect people and establish relationships that can turn into productive collaborative work (4). Furthermore, the online meetings have highlighted other 21st century challenges in science, such as/including diversity, equity and access to 'basic' infrastructure (e.g. internet, laptops, etc.). The participation in formal meetings via congresses has become increasingly expensive over the past years (3), and the scientific community is currently challenged to find ways to not make face-to-face congresses an exclusion activity, especially for scientists from low-income regions.

The pandemic condition seemed to increase the interest and openness of academic teaching staff to exchange experiences with the common goal of providing the best possible education, despite the limitations of remote teaching (1). Despite discrepancies in economic status and the facilities provided by universities, a common challenge was to ensure student engagement within classes (both physical and virtual) while also avoiding an overload to staff's schedules in having to prepare and deliver synchronous and asynchronous lectures. In this regard, many scientific societies assumed a protagonist's role in promoting opportunities for both academic staff and students in terms of continued professional development and interactive, engaging experiences.

In July 2020 the Brazilian Society of Biomechanics (BSB) promoted a webinar to discuss biomechanics research during the pandemic. The event was live-streamed and attracted attention on social media. However, additional questions remained, concerning biomechanics teaching. From informal conversations between members of the BSB and the South African Society of Biomechanics (SASB), emerged the idea of promoting an event to discuss the remote teaching of biomechanics in Brazil and South Africa. The event successfully transpired on August 28th, 2020. Here we report the organization and main outcomes of the webinar entitled "BIOMECHANICS WITHOUT BORDERS: TEACHING BIOMECHANICS IN BRAZIL AND SOUTH AFRICA".

ABOUT THE EVENT

The event was planned after online discussions about strategies for remote teaching and learning of biomechanics in 2020, and the discovery of similarities in the teaching realities from developing countries such as Brazil and South Africa. Members of the director board from BSB and SASB approved the webinar proposal presented by Helen Bayne (South Africa) and Felipe P Carpes (Brazil). The program was defined after a consultation with BSB and SASB members, who were invited to present their experiences with remote teaching of biomechanics by submitting a short proposal (150 words), stating the topic of the teaching activity and the main characteristics of the activities they would present. Four submissions were received (2 from Brazil and 2 from South Africa) and approved to be part of the webinar program. In addition to the submitted proposals, an additional invited speaker was added to the program presenting on general strategies for effective online teaching.

The webinar took place on August 28th, 2020 at 10 AM (GMT -3) 03 PM (GMT +2) with a planned duration of 1:30h. Speakers joined the event from across the globe (from South Africa: Pretoria, Potchefstroom, Johannesburg and Cape Town; USA: Marquette; Brazil: Uruguaiana and Belo Horizonte). The online streaming was delivered using a web conference tool (Zoom Video Communications, San Jose, CA, USA). All activities were recorded and edited, with the final video made freely available at the Brazilian Society of Biomechanics YouTube channel. The webinar was advertised on social media and online forums (Figure 1), with free online registration. Any person interested in joining was required to complete a short form for online registration. Thereafter the information to access the webinar was sent to the registered e-mail address.

Figure 1 near here please

The webinar started with a brief introduction of the speakers and the goals of the event which were presented by Helen Bayne and Yumna Albertus. The submitted proposals were presented in the order of the description below. Each speaker had 20 minutes for presenting and questions from the audience.

The first activity of the webinar was presented by the invited speaker, Sarah Breen, entitled “Active learning in online classes: getting in sync with your students”. The purpose of the presentation was to provide a general overview of active learning strategies for synchronous online instruction for biomechanics students. Sarah provided participants with information regarding technologies and strategies for think-pair-share, polling and brainstorming activities to increase student engagement

during synchronous remote instruction. Sarah also spoke about accessibility for students with learning disabilities and other accessibility issues, the use of closed captioning and low-tech engagement was outlined. This activity is available online at <https://youtu.be/tYfc48NwzDw>.

The second activity entitled “Qualitative movement analysis using mobile devices” was presented by Andrew Green with the main goal of showing strategies to create lab activities that students can perform at home using their cell phones. Although the use of cell phones and mobile applications for teaching has been discussed in previous studies (5), the context of limited access to internet and also computers at home, for a significant part of students from Brazil and South Africa, characterizes this strategy as an important step to promote the participation in remote teaching activities. This activity is available online at <https://youtu.be/mfsNWNl2Qd0>.

The third activity was presented by Andre de Andrade, in the form of a video tutorial entitled “Kinematics analysis: do it by yourself”. The video demonstrated an example of a tutorial intended for asynchronous use by students. This provided detailed instructions on the implementation of 2D kinematic analysis using free software, supporting practical activities related to biomechanics classes. This activity is available online at <https://youtu.be/cXSGDp3vEtc>.

Mark Kramer presented the fourth talk entitled “Using open-source software for kinematic analysis” aimed to report practical activities to study biomechanics concepts using open-source software for mainly kinematic, and to a limited extent some kinetic, analyses of human movements. The talk not only described the tools but also highlighted particular characteristics of the data, and suggested strategies to manage and analyze the data. The approach considered the use of the tools in a way the students not only can understand the technical aspects of the tools but also interact with and discuss the implications of the data collected across a broad range of movements. This activity is available online at <https://youtu.be/kIx3lpiCaTA>.

The final talk of the webinar was entitled “Adding asynchronous activities to the remote learning” presented by Felipe P Carpes. In this talk, the speaker described possibilities to add asynchronous activities in biomechanics classes to promote engagement of the students with the class contents, and also promote teamwork outside of scheduled class times when students could organize private meetings to discuss the topics of the classes. The talk also included suggestions for adapting the Biomechanics Olympic Games into a remote learning environment (2). This activity is available online at <https://youtu.be/RGSMS15U5v4>.

MAIN OUTCOMES AND CONCLUSIONS

People registering the webinar were from different countries (n=147 registrations [63% academic staff, 28% students, 9% other], being 48% Brazilians, 12% South Africans, and 40% from other countries). Approximately half of the registrants (52%) indicated that they had experience with remote learning before the pandemic and classified the remote teaching experience with a median rating of 7 out of 10. Forty-seven people participated in the live webinar, 33 of whom attended for the full duration (90 minutes). The low number of attendees relative to the number of registrants may be due to time zone challenges, or because we advertised that the recording would be made freely available after the session. However, it was encouraging that the majority of people who joined the webinar stayed for the entire program.

From the speakers' point of view, it was very interesting to note that a number of challenges and topics of interest related to remote biomechanics teaching were common across countries with differing levels of economic development. For example, the use of low-cost or widely used devices, free applications and open source tools was an approach favoured by a number of presenters and attendees. This approach could facilitate the engagement and experiential learning of students in the absence of regular face-to-face classes, in particular when applied to basic video-based movement analysis. However, the teaching of more advanced biomechanical methods that would typically require laboratory resources, cannot be easily adapted for implementation at home. There is clearly a need to expand on this with the continued development of novel technologies that may permit practical activities of other areas of biomechanics, such as inverse dynamics and electromyography.

In conclusion, we consider this pioneering event, which connected people from different countries and continents to specifically discuss teaching strategies for remote classes of biomechanics, to have caused a positive impact on the participants. To ensure that this impact is not limited to those who attended the live webinar, we have endeavored that the material will remain freely available for all on YouTube. Although the webinar did not involve costs for the organizers, we are grateful to the support of the BSB and SASB in the planning of the event. We hope that this first collaborative initiative will serve to motivate future events joining together members of these societies to promote a more diverse environment for the discussion of biomechanics teaching.

REFERENCES

1. **Byrnes KG, Kiely PA, Dunne CP, McDermott KW, Coffey JC.** Communication, collaboration and contagion: “Virtualisation” of anatomy during COVID-19. *Clin. Anat.*: 2020.
2. **Carpes FP, da Rocha ES, Kunzler MR, Mello-Carpes PB.** Using the Olympic spirit to improve teaching and learning process: The biomechanics Olympic Games. *Adv Physiol Educ* 41, 2017. doi: 10.1152/advan.00027.2017.
3. **Fellermann H, Penn AS, Fuchslin RM, Bacardit J, Goñi-Moreno A.** Towards low-carbon conferencing: Acceptance of virtual conferencing solutions and other sustainability measures in the alife community. In: *Proceedings of the 2019 Conference on Artificial Life: How Can Artificial Life Help Solve Societal Challenges, ALIFE 2019.* 2020.
4. **Lamming DW, Carter CS.** Maintaining a scientific community while social distancing. .
5. **Oyewole BK, Animasahun VJ, Chapman HJ.** A survey on the effectiveness of WhatsApp for teaching doctors preparing for a licensing exam. .

FIGURE CAPTION

Figure 1. Webinar flyer created for online advertisement.



BRAZILIAN SOCIETY OF BIOMECHANICS
SOUTH AFRICAN SOCIETY OF BIOMECHANICS



Biomechanics without borders: teaching Biomechanics in Brazil and South Africa



August 28, 2020

10am - Brazil (GMT-3)

3pm - South Africa (GMT+2)

Webinar duration 1:30h

