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Biomechanics without Borders: Teaching Biomechanics in Brazil and South Africa

Helen Bayne,[1] Yumna Albertus,[2] Sarah Breen,[3] Andrew Green,[4] André Gustavo de Andrade,[5] Mark Kramer,[6] and Felipe P. Carpes[7]

[1]*Department of Physiology, Faculty of Health Sciences, University of Pretoria, Pretoria, South Africa;* [2]*Division of Exercise Science and Sports Medicine, International Federation of Sports Medicine (FIMS) International Collaborating Centre of Sports Medicine, Faculty of Health Sciences, University of Cape Town, Cape Town, South Africa;* [3]*School of Health & Human Performance, Northern Michigan University, Marquette, Michigan;* [4]*Department of Sport and Movement Studies, University of Johannesburg, South Africa;* [5]*Laboratory of Biomechanics, Federal University of Minas Gerais, Belo Horizonte, MG, Brazil;* [6]*Physical Activity, Sport, and Recreation Unit, North West University, Potchefstroom, South Africa; and* [7]*Applied Neuromechanics Group, Federal University of Pampa, Uruguaiana, RS, Brazil*

Abstract

The "Biomechanics without Borders: Teaching Biomechanics in Brazil and South Africa" involved academics from different countries combining efforts to improve remote education. In addition to the live discussions, the event resulted in the availability of online content to help academic staffs improve teaching strategies in the field of human movement sciences.

biomechanics; human movement; internet; mobile; remote teaching

INTRODUCTION

The 2020 SARS-CoV-2 pandemic has necessitated alternative means of communicating and sharing content between colleagues (e.g., via webinars) and students (e.g., via 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 (1). 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 and laptops). The participation in formal meetings via congresses has become increasingly expensive over the past years (2), and the scientific community is currently challenged to find ways not to 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 (3). 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), there 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

Correspondence: F. P. Carpes (carpes@unipampa.edu.br). Twitter handles: @felipecarpes, @helenbayneZA, @markbio85, @sazbreen, @yumnaalbertus, @rugbybiomech, @sbbiomech, @biomech_SA
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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 (two from Brazil and two from South Africa), and these were 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 1:30 h. 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). 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, 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.

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/DgU2kmI0Lu8.

The second activity entitled "Qualitative Movement Analysis Using Mobile Devices" was presented by Andrew Green with the main goal of showing strategies to create laboratory 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 (4), 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 two-dimensional 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 at reporting 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 for data collection and the discussion of the results obtained. Therefore, students can also learn about the application of the results in different contexts of movement analysis. 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 (5). This activity is available online at https://youtu.be/RGSMS15U5v4.

MAIN OUTCOMES AND CONCLUSIONS

People registering for the webinar were from different countries [n = 147 registrations (63% academic staff, 28% students, 9% other): 48% from Brazil, 12% from South Africa, and 40% from other countries]. Approximately half of the registrants (52%) indicated that they had experience with remote learning before the pandemic [the question was: "Did you have previous experience with remote teaching before the coronavirus pandemic (as a professor or student)?"] and classified the remote teaching experience with a median rating of 7 out of 10 [the question was: "How would you rate your experience with remote learning in 2020?"]. 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

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tools was an approach favored 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 was welcomed by the participants and may cause a further impact on those that benefit from watching the videos made available on YouTube. To ensure that this impact is not limited to those who attended the live webinar, we have endeavored to make the material freely available. Although the webinar did not involve costs for the organizers, we are grateful for the support of the BSB and SASB in planning the event. We hope that this first collaborative initiative will serve to motivate future events joining members of these societies to promote a more diverse environment for the discussion of biomechanics teaching.

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DISCLOSURES

No conflicts of interest, financial or otherwise, are declared by the authors.

AUTHOR CONTRIBUTIONS

H.B., Y.A., S.B., A.G., A.G.A., M.K., and F.P.C. conceived and designed research; H.B., Y.A., S.B., A.G., A.G.A., M.K., and F.P.C. prepared figures; H.B., Y.A., S.B., A.G., A.G.A., M.K., and F.P.C. drafted manuscript; H.B., Y.A., S.B., A.G., A.G.A., M.K., and F.P.C. edited and revised manuscript; H.B., Y.A., S.B., A.G., A.G.A., M.K., and F.P.C. approved final version of manuscript.

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