Digital Food Physics and Engineering: Learning Material for Everyone

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Objective
While quantitative, model-based understanding of food physics and its applications to computer-aided manufacturing is expanding rapidly, educational programs to prepare a future workforce well-versed in these topics have roadblocks such as unavailability of content at an appropriate level, missing pedagogical frameworks for effective learning, and the lack of sufficient learners at any one place to justify the effort. We address this by developing pedagogically rich, modularized, active learning-enabled, multistage content that is synthesized from recent research, and make it available freely on a Massive Open Online Course (MOOC) platform.

Methods
The modules are multi-level and connected for three groups of learners (academia and industry)—engineers with basic transport phenomena knowledge, researchers interested in modeling of complex processes, and food or related scientists without any mathematical background. The learning outcomes include the ability to: 1) Explain a food physics framework in terms of its basic building blocks that can describe many food processes, 2) Compare and contrast between simpler and more comprehensive physics frameworks for understanding food processes, 3) Apply a food physics framework to complex food processes for understanding and optimization.

Module contents move from the simplest to the most complex--from lumped to multiphase/ multicomponent transport in porous media with shrinkage/expansion. Mechanistic frameworks for food quality and safety complement the process framework. Applications come from different processes.

Results
Of the planned 30 modules, 15 have been completed and half of them have been used as part of a hybrid learning workshop at the Conference of Food Engineering ’22. The rest will be completed in the coming weeks. Feedback from the workshop shows the learners found the modules useful, engaging, providing the necessary background information, and having clarity of instructions.

Conclusions
Learner evaluations of the course’s initial offering showed that the MOOC-based approach with active learning should work for a range of backgrounds and abilities in an international setting, covering industry and academia. The modular approach will enable customization and inclusion in existing courses. The MOOC platform will provide scalability, assessment with instant feedback, and ease of evolution. All this should propel food physics/engineering education to a level appropriate for today.