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A case for miniature demonstration apparatus

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A challenge that is perhaps common to many universities is that of large class sizes, particularly at the first-year level, with ever-larger lecture venues being needed to accommodate the ever-larger classes. As a result of this trend, physics teaching staff in our university have increasingly found themselves teaching in venues that are not only remote from their usual "home territory" but are usually not structurally suited to teaching physics – especially not for doing lecture demonstrations - even though in most cases they were quite well suited to teaching - or at least to lecturing - in a very broad generic sense. The remote locations of some of these venues and the difficulty of moving demonstration apparatus – which is of necessity usually large in scale – has resulted in the lecture demonstration increasingly becoming a thing of the past. A possible solution to this problem is to make the demonstration apparatus small enough to carry - and to project an image of the apparatus in action using a portable document camera. The document camera needs to have a short focal length so that the depth of field is reasonably large, otherwise it becomes impossible to focus on more than a very thin plane of the apparatus at any one time.
While the efficacy of lecture demonstrations as a teaching tool has been much debated (Crouch, Fagen, Callan, & Mazur, 2004) - the consensus does seem to be that they can be of value provided that the students are not expected simply to watch passively (Sharma et al., 2010; and Miller, Lasry, Chu, & Mazur, 2013).
The presentation will show the feasibility of this solution, using a small sample of suitable apparatus in conjunction with a portable document camera. Other potential uses of the document camera as a teaching tool will also be mentioned.

References:

Crouch, C., Fagen, A. P., Callan, J. P., & Mazur, E. (2004). Classroom demonstrations: Learning tools or entertainment? American Journal of Physics. http://doi.org/10.1119/1.1707018
Miller, K., Lasry, N., Chu, K., & Mazur, E. (2013). Role of physics lecture demonstrations in conceptual learning. Physical Review Special Topics - Physics Education Research, 9(2), 1–5. http://doi.org/10.1103/PhysRevSTPER.9.020113
Sharma, M. D., Johnston, I. D., Johnston, H., Varvell, K., Robertson, G., Hopkins, A., … Thornton, R. (2010). Use of interactive lecture demonstrations: A ten year study. Physical Review Special Topics - Physics Education Research, 6(2), 1–9. http://doi.org/10.1103/PhysRevSTPER.6.020119

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