PHYSCLIPS: Multimedia Resources for Learning and Teaching Physics

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Abstract: *Physclips is an integrated set of freely available online resources for the teaching and learning of physics at the level of senior high school or introductory university. The architecture of Physclips comprises narrated tutorials, interactive support pages and laboratory activities. High levels of user control and extensive cross linking between the resources ensures that the learner can customize their own learning pathway. Physclips has won national and international accolades and is currently developing Chinese/English bilingual resources.*
Keywords: physics, animations, multimedia, re-usable learning objects, laboratories

1. The Physclips Platform

Physclips is a freely available suite of online resources for learning physics, or for teaching it, at the level of senior high school or introductory university. Currently, it comprises completed multimedia-rich volumes on Mechanics, Special Relativity, Sound and Waves, and has various collections of material for electricity, magnetism, light and thermal physics (see Figure 1).

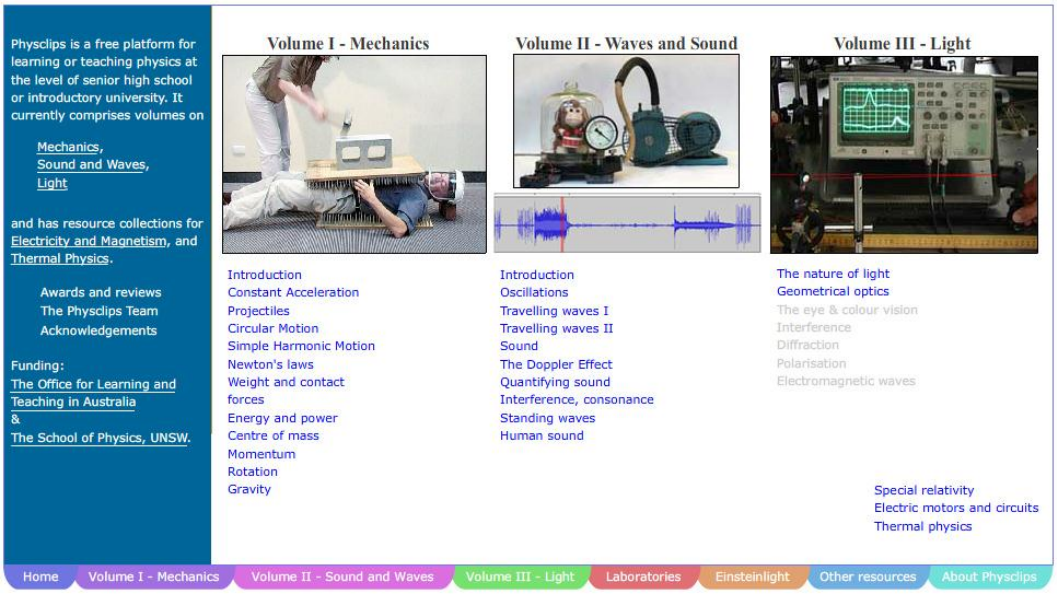

Figure 1. Screen shot of the Physclips Platform menu options.

Physclips is the outcome of collaboration between a physics professor and an educational multimedia designer. The creative elements of production are moderated by student feedback and evidence-based guidelines (Hatsidimitris & Wolfe, 2009). The design and delivery of Physclips are generally consistent with multimedia learning principles that are particularly applicable to dynamic visualisations. The manner in which Physclips resources incorporate the modality effect, signaling cues, spatial contiguity, segmentation and other cognitive design principles (Mayer, 2009; Sweller, Ayres, & Kalyuga, 2011) can be viewed at http://www.animations.physics.unsw.edu.au/educational-animations .

Within each volume, each chapter has a rich, interactive, narrated, multimedia overview, including film clips of key experiments and demonstrations. The emphasis on film clips ahead of animations is a key design decision: physics is after all an experimental science. Ideally, physics is taught via experimentation, and for some of the materials Physclips suggests home experiments using simple, inexpensive materials. For on-line instruction, a film clip shows what happened,

rather than what is predicted by the equations, which are inevitably idealised to some extent.

Animations are useful for explaining subtleties in real experiments. Physclips combines video of real events with animations showing things not readily filmed, such as varying vectors, fields, energies etc. These allow novices to experience the view of the expert whose mind's eye 'sees' these abstractions.

Throughout Physclips, whether in multimedia or html components, links appear to related support pages, giving access to further explanation as well as deeper, broader material. Interactivity and other features enable students to tailor their own learning paths according to their levels of prior knowledge and learning objectives.

Research conducted into learner control using Physclips (Hatsidimitris & Kalyuga in press) resources has guided and refined the design of a visually and semantically indexed scrollbar. Icons and keywords located under the scrollbar facilitate selective replay whilst the overall flexibility and control afforded to the user by the scrollbar ensures that the cognitive load imposed by the learning task can be instantly and fully moderated. Research results indicate that novices can benefit from explicit instructional advice regarding the optimal manner in which to employ the scrollbar for study and revision.

The film clips and animations used in Physclips are available as re-usable downloads, either individually or in a compressed folder, so that teachers can incorporate them directly into their own lessons.

2. Dissemination of Physclips

Physclips and its components have won international prizes and highly positive reviews in the scientific and popular media. Resources from Physclips are used by teachers in leading universities and by teachers and learners in areas deprived of quality teaching materials. Typically, a few thousand individual different users access Physclips each day, worldwide. The project is currently translating a number of the resources to bilingual Chinese/English web pages in order to assist students with a Chinese speaking background who may be encountering difficulties with comprehension.

Physclips is at http://www.animations.physics.unsw.edu.au/

Acknowledgements

Support for this project has been provided by The Australian Office for Learning and Teaching, an initiative of the Department of Industry, Innovation, Science, Research and Tertiary Education. The views expressed in the paper do not necessarily reflect the views of The Australian Office for Learning and Teaching.

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