

# MasteringPhysics™

## EDUCATOR TESTIMONIAL THE UNIVERSITY OF MANCHESTER

<b>COURSE:</b>	Dynamics (1st Year)
<b>TEXT IN USE:</b>	<i>University Physics</i> , Young and Freedman
<b>USED SINCE:</b>	2009
<b>SUMMARY:</b>	By using MasteringPhysics as part of a Just-In-Time teaching approach on a first year Dynamics course, University of Manchester increased the average grades and significantly reduced the failure rate. Students rate MasteringPhysics as valuable for their learning.
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Finally, we obviously wanted to enhance examination performance.

### Assessment

There are 11 credit-bearing MasteringPhysics assignments which, in total, are worth 15% of the module marks. Students obtain full credit for an assignment if they score at least two thirds of the average mark for that assignment. So, although the assignments are formative assessments, students nevertheless have an incentive to submit them.

### Implementation

Just-In-Time Teaching was originally devised by Gregor Novak<sup>(1)</sup> in the US. The approach follows that the content of one's classes is decided at the last minute and is based on the results of assignments which the students submit electronically just a few hours before the class. We have adopted a slightly modified

### Course design

The School of Physics and Astronomy at The University of Manchester has an annual intake of approximately 250 students. All first year physics students take Dynamics, which covers classical Newtonian mechanics, as a core course during their first semester. The course lasts for 11 weeks. The students' previous knowledge and experience varies – some students will not have studied any mechanics modules within their Mathematics A-level, whereas others may have studied as many as four or more. Prior to 2006, this course was taught in a very traditional manner with two one-hour lectures per week supported by a weekly workshop and small group tutorials. Unfortunately it suffered from relatively poor examination results and mediocre student feedback compared with the other first year courses. In 2006–07 we radically changed the delivery of the course by introducing several student-centred teaching techniques. These included Just-In-Time Teaching, e-learning and e-assessment. For the latter we used MasteringPhysics.

Our aim was to increase the students' engagement with the material and encourage them to take responsibility for their own learning by providing a much more student-centred approach. We wanted to change their attitude to learning from one of wanting to be 'spoon fed' to one of constructing their own understanding. A further objective was to instil deeper conceptual understanding rather than superficial learning merely to pass exams.

*We study the analysis of the students' performance provided by MasteringPhysics and identify the key concepts and problems with which the students are struggling.*

Just-In-Time approach. The two traditional lectures have been replaced by a single 'overview' lecture at the beginning of each week. This is not an in-depth lecture, rather, it introduces the students to the material they need to study that week. After the lecture the students are required to construct their own understanding by studying the course material which is available online in our virtual learning environment. A rich suite of e-learning material is provided including over fifty 'talklets' and numerous 'physlets' (Java applets). The talklets are mini PowerPoint presentations with voiceovers – used to aid understanding of complex concepts or problems. Once the students feel that they have a reasonable understanding of the material for that week, they are required to do a MasteringPhysics assignment which consists of between 4–6 problems selected from the MasteringPhysics problem library.

Students are required to submit their weekly assignments by 9 a.m. on Friday, then on Friday mornings we study the analysis of the students' performance provided by MasteringPhysics and

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identify the key concepts and problems with which the students are struggling. For example, at the beginning of the course students generally find the notion of determining algebraic (as opposed to numerical) solutions to problems difficult. This enables the content of the JIRP (Just-in-Time Response and Problem) sessions, which are held on Friday afternoons, to be decided. For these sessions, the cohort is divided into four groups and the students work through problems which focus on the key areas of difficulty as revealed by the MasteringPhysics assignment. Students are encouraged to discuss the problems with one another and each of the four groups is supported by a member of academic staff and a postgraduate assistant.

For further details see Birch and Walet<sup>(2)</sup>.

### Course results and conclusions

#### ANECDOTAL EVIDENCE

Students were not enamoured with MasteringPhysics during the first year that it was introduced and student feedback was poor. Since then we have modified the problems to remove American notation and we have also added hints to the End-of-Chapter problems. This has greatly enhanced student satisfaction, and in a student poll conducted at the end of 2009–10, 49% of students rated MasteringPhysics as the most valuable aspect of the Dynamics course, in terms of aiding their learning.

Generally, over 90% of students submit the MasteringPhysics assignments each week. This is a significantly better submission rate than that obtained for the weekly tutorial work.

#### STATISTICAL EVIDENCE

Examination performance has improved since the introduction of this integrated teaching approach. The average mark is, generally, approximately 10% higher than it was previously. Furthermore the failure rate has decreased significantly – from 32% to 5–14% in recent years.

### Conclusions

MasteringPhysics has enhanced the delivery of the first year Dynamics course at The University of Manchester. The weekly MasteringPhysics assignments help to ensure that students keep up with the course material as it is delivered, rather than leaving their learning until just before the examination at the end of the course. They also provide students with a further opportunity to practise problem solving in addition to their usual tutorial work.



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### References

1. Novak, G.M., Patterson, E.T., Gavrin, A.D. and Christian, W. (1999) *Just-in-Time Teaching*, Prentice Hall, Upper Saddle River: NJ.
2. Birch, M. and Walet, N. (2008) 'An integrated approach to encourage student-centred learning: A first course in dynamics', *New Directions in the Teaching of Physical Sciences*, The Higher Education Academy, Issue 4, 21–6.

