

Game-based learning with the Racing Academy

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This case study has been developed from data gathered through observations of the teaching component; interviews with the tutor; and student focus groups.

Background

Over the last few years the tutor has developed a portfolio of teaching and educational tools that are based primarily on community building, pragmatic diplomacy and play. One example is Racing Academy, developed by working closely with a software house to design a computer car racing game which, combined with a practical dragster design and build competition, supports his teaching of engineering dynamics. Racing Academy was originally developed using JISC funding to support the teaching of engineering in schools and is a game engine based on underlying physics *“specifically designed as a way to engage and motivate students. It aims to achieve this by engaging them in tasks that are authentic, that involve real practice and through which they can see the effects of their choices, interventions and actions”*¹.

This case study showcases the use of Racing Academy in a first year lab unit and Solid Mechanics and Dynamics module with 200 mechanical, aeronautical and automotive students studying a common core first year. The software uses principles of engineering dynamics to simulate and display, in real time, a car drag race in which students modify their car from a set menu of components. The tutor *“designed the work sheet based around the software to try and lead them [students] through the process of Racing Academy and to push them into thinking about the science, rather than just the game playing”*. Introduced as part of their lab unit, students are given a set number of weeks to work through an activities booklet, record their best drag race time based on their experiments and write a lab report. There are no timetabled sessions to access the Racing Academy but the students can discuss their activities within their weekly personal tutor group meetings and through the online discussion forum in Moodle. The lab report mark contributes to the overall assessment of the lab unit.

A grant was received by the tutor from the University Teaching Development Fund, to help to evaluate the first trial of the activities. The pilot study involved 161 students (146 male and 15 female) and ran over a three week period. Pre and post tests that assess the student’s knowledge of engineering, their attitudes towards engineering and their attitudes towards computer games were undertaken. Examination of learning diaries and two focus groups were used to evaluate student attitudes towards using the technology. 81% of the students thought that the exercise was enjoyable and the overall responses were positive with students commenting that they were comfortable with and enthusiastic about using game-based software as a teaching tool.

¹ <http://www.jisc.ac.uk/whatwedo/programmes/elearninginnovation/racing.aspx> [accessed 16 April 2009]

Reasons for introducing this teaching approach

Introducing Racing Academy was seen as *“an interesting trial to see whether game based learning could be used as part of the learning process”*. The main interest in its introduction was *“an educational one”*, activities were designed around the game with the specific intention to support the student induction process making this *“part of a tutor group activity”*. Due to the high numbers of first year students (*“they can’t all do the same lab at the same time”*), lab activities based on a computer simulation were also seen as an opportunity to support the normal lab programme, with students completing a lab exercise and writing it up *“at an early stage to get feedback for subsequent reports”*. Prior to the introduction of Racing Academy, timetabling constraints had led to some students not receiving lab report feedback until mid way through the first semester.

Lecturer Perspective

The software was developed so students could access Racing Academy through both using the computer lab or their own machines. *“So I suppose the only issue that did arise was some of them were using it in the library and they got moaned at playing games in the library”!* The context of a racing car to teach the fundamentals of solid mechanics was seen as *“an interesting sort of thing for your budding engineer”*. Racing Academy *“launched them [first year students] on the whole report writing side, as well as the engineering side”*. Some of the engineering principles demonstrated through Racing Academy are *“more advanced than the content of solid mechanics that we’re currently teaching ...but we felt it was better to do it at the start”* as part of the induction process.

Students’ perspective

The primary focus of the activity was seen by the students as a way to teach them *“how to write a lab report”*. It was seen as *“a good introduction”* for students who had not done a lab report before as it was *“also just sort of a fun way to get to lab reports because it’s nothing too heavy or too scientific”*. The students welcomed the *“step by step”* nature of the Racing Academy activities. They felt it was good *“because you could change all the different aspects of the car”* but that these aspects were not all introduced at once. One student commented that *“actually understand a lot more about engines than I did two weeks ago”*.

The work was tackled individually but did provide a common topic for discussion, *“Every day when we meet the first thing we ask is ‘what’s your time now?’ ”*. Students would *“discuss the best profiles”* within tutor sessions before returning to *“try them out”*.

The focus group included students who would *“never play games”* and those who described themselves as *“a game player”*. Students thought the level was appropriate for them as first years as *“it did teach quite a lot if you’d come in not having experience”*. Activities were structured in such a way that it made *“everyone go through the steps”*. Interest was maintained for those with more experience as *“You had a bit more freedom of what you wanted to investigate, not just a lab and you’ve set instructions”*. The interactive nature of the activities also meant that students were *“not sitting there listening to people ...”* and got *“... to try out some stuff”*. *“Yeah, I think it’s much better to try it out, rather than being taught”*.

The generation of the various graphs and curves was seen as a key feature of the simulation helping them to learn about the different engines as the graphs showed how changing difference parameters *“affect the performance of the car immediately. If you didn’t have the actual visualisation or simulation”*

there, you'd just be like well I'm told in this book that if the torque curve's higher, the engine will go faster but it's easier to just see it happen".

If the Racing academy hadn't been used students felt that they *"would have been more reluctant to learn it, if it wasn't so fun". "A regular lab report might seem more like jumping in at the deep end" and "I think even if you're not interested as such in cars, it's a lot easier to get into"*.

Issues

Currently the user skill required to drive the car in the simulation is considered quite low – *"even the academics can do some of it"*! User skill *"is influential in terms of the performance"* and the tutor considers it important that the game is not over developed assuring *"that user skill doesn't dominate"* causing students to become *"disenchanted"* if they could never achieve results equivalent to their peers.

Following the introductory session students would have found it useful to *"go off into groups ... around the computer and watch somebody else do it "* with some students feeling they *"weren't entirely sure what we were supposed to do"* early on.

Benefits

The simulation proved to be *"good at illustrating physical phenomena"* helping students in *"predicting behaviour and allowing the students to design, make design changes, to improve performance"*.

The discussion forum on Moodle was also seen as a useful way to communicate, *"students can talk to each other [on the forum] so you may not know them by face but you've spoken to them on that about the topic"*. The students *"chatting together via Moodle"* was also seen as a positive outcome from the tutor perspective who was unsure *"whether they would engage with that or not"*.

The tutor responsible for this innovation argues that 'Following the introduction of Racing Academy the students have received more timely feedback on report writing and this has enabled them to improve their subsequent lab reports. In addition the staff and students have engaged more fully with the tutorial sessions as there has been a better focus for the meetings. It is also noticeable that the students are better equipped to deal with the teaching of gearbox and engine dynamics that traditionally follows in semester 2.

Reflections

Whilst one student commented that their peers from other programmes were *"jealous"* of their homework tasks, another felt that *"you couldn't really call it a game, it's too much like hardcore work but it's just a bit of fun at the same time"*. If advising other students introduced to Racing Academy in the future students would suggest *"start a lab report early "* and *"don't just play the game"*. Subject areas were similar applications could be used well included *"thermo stuff"* and aerospace with a *"flying academy game"*.

The lack of next generation console graphics was not seen as a barrier to engaging with the simulation with students highlighting the *“the accuracy of simulation”* as the most interesting aspect. *“You spend most of the time watching the revolutions meter”*

Overall *“the staff have been quite supportive”* not just seeing this as *“yet another new idea”*. The department are continuing to use the Racing Academy activities *“It is serving a useful purpose and it has ticked many of the boxes that we’d hoped for at the start”*. The activities involve *“other staff via their tutor role”* but without *“a huge amount of effort”* and *“there are a number of good things about it which we’ll [the department] want to retain”*.

Future developments to the activities and the software tool could include *“fuel economy ... because I think it’s a topical subject and indeed, you could expand it, well beyond the university environment”* and additional questions to the students to encourage them to think about factors such as *“the weight of the car and the centre of gravity position”*.