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# Adventures in Learning: Creating Role Playing Video Games to Teach and Learn Economics

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## Abstract

This article examines pedagogical lessons derived from the learning theory embodied in commercially successfully video games and their link to reported increases in 'fluid intelligence' of student populations. The scholarly literature in this area is reviewed in order to elicit practical principles by which to guide the development of instructional video game modules for the teaching of economics. The authors' experiences in developing and pilot testing such a module, and in subsequently guiding student research efforts to develop an additional module, are then reviewed. The paper concludes that harnessing the benefits of video game technologies in the service of teaching and learning economics is both pedagogically sound and feasible for individual instructors.

## Introduction

Despite the fact that intelligence testing indicates that populations around the world are rapidly becoming more capable (known as 'the Flynn Effect'), employers and educators fear that the quality of education received by the traditional college graduate is declining (see Dillon 2005 and Lewin 2005). Lecture-format education, while offering certain advantages, traditionally relies on the delivery of abstract content and deductive learning models to address and enhance what is referred to in the language of psychology as *crystallised* intelligence. World-wide intelligence gains, however, appear to be taking place primarily in the area of *fluid* intelligence, the type of cognition involved in inductive learning, adaptability in problem solving, and the understanding of new contexts.[1]

This article explores how higher education can tap into these trends by utilising lessons from commercially successful video games. Interest in such an approach is growing rapidly, with major advocates drawn from such diverse arenas as the 'Serious Games' movement, the commercial game and broadcast industries, and leading academic institutions such as MIT, Carnegie-Mellon and the University of Wisconsin. This variety of perspectives on the link between fluid intelligence, experiential learning and video games is reviewed below, as are a set of practical principles that can be inferred from this body of work. We then share our experience in attempting to put into practice the pedagogical lessons emerging from this discussion. Specifically, we review our experience in two activities: 1) developing and testing a video game module to assist in teaching portions of Principles of Microeconomics; and 2) a subsequent summer research project in which two senior economics majors and an incoming freshman were invited to develop the next segment of the game. We conclude with a short summary of lessons learned, both from the perspectives of the student-developers and of the professors.

## Diverse groups, one message

The wide array of applications for the learning theory incorporated in commercially successful video games has led to the development of a movement known as 'Serious Games'. The group began in the late 1990s by sponsoring an annual conference, the 'Serious Games Summit', to showcase new developments in the area. (This summit has now become a regular segment of the large Game Development Conference held every spring in San Francisco.) Participants in the serious games movement range from corporate trainers to educators to government agencies to advertisers. All believe video games offer fertile ground for conveying their message to target audiences in a manner that will produce more powerful and authentic results than traditional media. Prominent among organisations committed to this endeavour are the U.S. Army, the National Science Foundation, an array of medical/health information organisations and professionals, first responders, the U. S. Department of Education, and educators drawn from both K-12 and the higher education community. Indications of how successful some of these organisations have been in pursuing this initiative are regularly on display at the summit. Over 6 million people registered to play a game previewed there, *America's Army* (free to download), which was originally developed as an 'advergame' to help the army in its recruiting drive. *Hazmat HotZone*, an 'edugame' for firefighters that was unveiled at a recent summit by developers from Carnegie-Mellon, attracted standing-room-only crowds who reported sharing the tension and emotional turmoil of play as they observed NYC firefighter trainees working through the game (see Harz 2005). Such dramatic examples of success





with the video game format for learning have been absent in the academic arena thus far but, as the academic work reviewed below suggests, this may be changing.

Voices from the industry have also weighed in on this subject in a multiplicity of ways. A speech given by British music industry executive Adam Singer observes that 'They [the public] see children taught by games in the classroom as bad, yet pilots taught by a simulator as good –what's the difference between a simulation and a game?' He goes on to observe how easily the point is missed that children (and adults) playing video games for hours on end do so because they are *engaged*, and this power of engagement can be harnessed in the service of education (Singer 2005). In a somewhat more evocative vein, Will Wright, the creator of one of the most successful video games of all time, *The Sims*, echoes the suggestion that people are in fact learning differently when they play video games. He goes even further, however, making the following observation (Wright, 2006):

> In an era of structured education and standardized testing, this generational difference might not yet be evident. But the gamers' mindset – the fact that they are learning in a totally new way – means they'll treat the world as a place for creation, not consumption. This is the true impact videogames will have on our culture.

If borne out, such a development would realise at least one long-standing objective of experiential education: enhancing the ability of individuals to develop their own creative potential. Encouragingly, some major new games introduced recently, such as *Little Big Planet, Boom Blox* and *Spore*, incorporate player creation of content as a fundamental component of game design.

Finally, in the area of academic theory and practice, there is a growing body of scholarship concerning the learning that takes place in video games. One foundation for this literature is the development mentioned earlier regarding IQ scores. Intelligence is no longer considered the homogeneous 'general intelligence' that it was thought to be in the first half of the twentieth century. Rather, it is believed to be comprised of at least two components, the quantity and relative proportions of which differ across both individuals and generations (see Horn and Cattell 1966, Carroll 1993, Mackintosh 1998, Sternberg 2008). The traditional concept of intelligence, crystallised intelligence, is dominated by the ability to master facts and theories and then *deduce* correlates. Crystallised intelligence has been rising in the U.S. population, but not enough to explain the rate of gain in overall intelligence. General intelligence, as measured by IQ scores, has been rising faster than crystallised intelligence due to the more rapid rise of the second component of general intelligence, i.e., fluid intelligence (Flynn 1999). This development is explored in more detail in the next section.

## Fluid intelligence and inductive learning

Fluid intelligence is the ability to discern patterns in new data and events, then make generalisations about and extensions of those patterns (Cattell 1987). Fluid intelligence is applying one's working memory and reasoning ability to practice *induction* in new situations (Lohman 2001). People high in fluid intelligence are more capable than others of seeing trends, taking on new sorts of problems, and adapting to new environments. Whether these gains in fluid intelligence are the cause or the consequence of societal change, the rise in fluid intelligence in populations across the developed world is occurring at an opportune time, given the pace of societal transformation resulting from technology, information and globalisation. To enable participation and success in a rapidly changing world, higher education might do well to place more emphasis on recognising and developing students' fluid intelligence.

Most teaching in higher education today is delivered in the traditional lecture with readings format. Using such a format, instructors deliver generalisations or governing laws for their disciplines that students learn and then apply in exercises. This approach utilises primarily the practice of deductive reasoning, and rewards primarily crystallised intelligence – not the faster growing fluid intelligence. People higher in fluid intelligence may be less tolerant of passive, deductive schooling formats. If education is to accommodate fluid intelligence, inductive educational opportunities should become a greater part of the curriculum. Active, inductive teaching methods may communicate better to a more fluid-intelligent audience and result in better student attention, greater understanding and higher standardised test scores. Thus, experiential education has never been of more relevance than it is in the present environment.

Fluid intelligence may be nurtured by contemporary popular culture, including video games; this is discussed more fully below. It should be immediately noted, however, that this is not an argument for the inclusion of current television or commercial video game *content* in the higher education curriculum. Intelligence is a general *capacity* to learn; it is separate from the content learned. Students (and their parents) are increasingly intelligent creatures, apparently willing to spend lots of time involved in challenging play. This may be increasing their learning capacity and it may be helping them learn new ways to learn. Their efforts spent with popular culture inputs, however, do not provide a great deal of stored *content* that subsequently can be applied over a wide array of application domains and longer time periods – it is not 'education' at least in the content sense of that term. History, biology, economics, and accounting still need to be taught, as do writing, speaking, information literacy and mathematics. Popular culture may communicate with and entertain young people. It may be utilising or even creating fluid intelligence capacities. But students still need to apply that intelligence to content that will further their adult endeavours as parents, citizens, and employees. Learning *traditional* content more inductively, however, may serve the purpose of having students learn it better and learn it in a way that allows for more effective decision making.

A number of scholarly works have begun to emerge arguing that video gaming is one such fluid-intelligence-based inductive process, and that the best video games are commercially successful precisely because they embody a potent theory of learning. The popular bestseller *Everything Bad is Good For You* (2005) by cultural observer Steven Johnson makes this case across a broad spectrum of media, with special emphasis on video gaming. An earlier and more academic treatment of the subject, *What Video Games Have to Teach Us About Learning and Literacy* (2003) by James P. Gee, has become something of a classic and spawned a great deal of research into the nature of learning that goes on in video games. This literature is briefly reviewed in the next section, with an eye to distilling a set of concrete, practical principles by which to guide instructional design.

## Learning and video games

The newly emerging literature concerning the integration of video games into academic pursuits, and especially the identification of the underlying learning principles embodied in commercially successful video games, already contains a wide variety of perspectives. The array of theoretical treatments contained in this work is impressive, in view of the very recent pedigree of the field, and already there seems to be considerable consensus about what works and what does not. For example, several leading game scholars suggest that good games create the experience of an 'authentic professional'. That professional may be a lawyer, a journalist, a soldier or even a skateboarder – what is important is that there is a matrix of knowledge, skills, and values that define this as an identity (Gee 2005b). Through the game play, the participant begins to 'think like' such a professional, incorporating the profession's practices regarding 'ways of knowing, ways of deciding what is worth knowing, and ways of adding to a collective body of knowledge' (Shaffer 2004). This type of approach, it should be noted, may easily be extended to include 'thinking like an economist'.

Edward Castronova, an economist who has looked especially carefully at massively multiplayer online role playing games, has noted that video games should not attempt to usurp the traditional terrain occupied by text and drama – reading Shakespeare's plays or watching them performed by live actors onstage will always trump what would be possible in a video game portrayal of such works. But what video games can offer to a much greater degree than these other, more traditional

media is two things: immersion and interaction (Castronova 2005a). Given that learning involves not only mastery of content, but engagement and motivation, such attributes would seem to be central to the learning potential afforded by video games. As Gee points out, '…*to know* is a verb before it is a noun, *knowledge*' (Gee 2005b). Experiencing directly the ideas that we conventionally convey only through the indirect means of words and symbols becomes feasible within the rich virtual world of video games, and this has a powerful impact on learning.

Gee's work explores two additional ideas that are particularly helpful in understanding the learning potential of video games: 1) the ease with which 'just in time' delivery of information can take place; and 2) distributed knowledge (see Gee 2005b; Gee 2005a; Shaffer *et al*., 2004). The first idea, reminiscent of discussions of the 'teachable moment,' suggests that new information is more easily assimilated and more permanently retained when it is acquired in manageable portions and in a context where its usefulness is readily apparent. Also, in situations where the student's first impression is incorrect, 'just in time learning' allows that impression to be supplanted by correct information right away, producing better recall and less confusion. The second idea, distributed knowledge, focuses on the potential for the artificial intelligence embedded in the game to provide part of the knowledge the player needs to negotiate new situations. The characters built into the game (referred to as NPCs – non-player characters) can share with the player facts and theories the player needs to learn, which then can be combined with his/her skills and judgement to successfully navigate and complete the objectives of the game. Thus, this distribution of knowledge between the player and the artificial intelligence affords the opportunity for the successful *mentoring* of the player *by* the game *through* the game. With distributed knowledge, a student is not required to learn all of the important concepts before entering the application phase of the experience but, rather, as in life, learns during the process. This 'learning by doing' is referred to by Gee as 'performance before competence' (Gee 2005a).

It also has been suggested that these principles, and others like them, can be applied in simulations (i.e. live role playing) and other types of experiences that lack the sophistication and expensive technological development of a video game but contain its critical elements. Regardless of the specific content of the scenario, according to these researchers, such an experience must: 1) *be consistent and coherent* (to be believable); 2) contain clearly defined student roles that are perceived to *require decision making with important consequences* for the outcome of the activity; and 3) provide feedback that is intrinsic to the game and is *immediate and true* to the scenario being played out (Begg *et al*. 2005). Thus, the lessons provided by the learning theory embedded in video games may be applied more broadly to expand and improve the quality of various types of experiential education.





## Practical principles for designing an instructional video game

Increasingly, the conclusion reached by serious observers of popular culture is that students *will* learn from video games – the only real questions, then, concern *what* they will learn and *who* will create the content (Shaffer *et al*. 2004). The video game industry has become an established and increasingly risk-averse domain. Indeed, at this juncture, much of what is expected from industry is not the new and the creative but, rather, the predictable – low-risk sequels and film-related games. However, one very bright spot in this picture is that a number of contemporary games offer 'toolkits' as a part of the purchase price of their games. This supplemental software allows game enthusiasts, or 'modders', to create their own content as add-ons to the game. It is provided by the game manufacturers because they have found that modding activity on the part of established players extends the shelf life of their games. The new content created by modders still requires the original game CD or DVD to run, so if the modders wish to share their creation with others, they will encourage their friends to purchase the game (see Castronova 2005b).

This modding software, called *middleware*, is becoming both more sophisticated and more user-friendly, requiring minimal understanding of programming principles to create professional quality results. As such, it offers educators an ideal opportunity to create their own video game ancillaries, specifically tailored for their purposes, to replace or complement other, more traditional instructional materials. As this type of tool becomes more refined, more powerful and even more user-friendly, these opportunities are likely to expand. The result is that the focus of the development process for educational video games is increasingly shifting to *content* expertise rather than *computer* expertise, clearly a welcome development from the point of view of utilising the talents and achieving the goals of educators.

In order to encourage and facilitate experimentation in the creation of video game modules by educators, it may be useful to articulate some basic principles that can serve as guideposts for such an endeavour. The discussion earlier in this paper, as well as our own personal experience with modding thus far, would suggest that the following set of eight principles be followed as closely as possible:

- Don't take the **fun** out.
- **Show**, don't tell.
- Keep students working at the **outer edges** of their competence, but don't push beyond that frontier.
- Make sure the experience is **immersive**, **interactive** and **social**.
- Deliver information on a '**just-in-time**' basis.
- Distribute knowledge as a means of **mentoring**.

- Provide meaningful **roles** for students and include many opportunities for **decision making** with consequences.
- **Feedback** is crucial – ideally, the game should respond to *every* action that the player takes.

In order to demonstrate these principles and illustrate more generally the ideas in this paper, the next section takes a look at several video games that have enjoyed commercial success or won wide recognition, but have succeeded in varying degrees at embodying the principles enumerated above.

## From the United Nations to skateboarders' paradise

The games we have chosen for the purpose of illustrating the ideas discussed in this paper are as follows:

- *Food Force* – produced in 2005 by the United Nations to educate the public about world hunger and U N food relief efforts.
- *Syberia* – produced by Dreamcatchers Interactive and named 'Adventure Game of the Year 2002'.
- *Tony Hawk's American Wasteland* – produced by Neversoft for the X-Box console and wildly popular among K-12 students.
- *World of Warcraft* – produced by Blizzard Entertainment and the most successful massively multiplayer online role playing game ever, with 10 million players worldwide.
- *Journey to Akerloff* – the game we have begun developing using the Aurora Toolset of *Neverwinter Nights* for the purpose of teaching Principles of Economics.

The first two games, though very popular, largely provide examples of the above principles being violated. *Food Force* is an example of 'games for change', a movement that attempts to use video gaming to educate and inspire support for a wide variety of efforts by non-profits to address social problems. This game is available free on the web and has been downloaded by millions of people (albeit many of them schoolchildren playing at the behest of their teachers). It has been highly touted as a creative and successful humanitarian endeavour. As an example of harnessing the power of the learning theory embedded in successful commercial video games, however, *Food Force* does not stand out. The film and narrative portions of the game *tell* a lot of information about the problem of world hunger and the UN's responses to it, but the game generally fails to *show* it. The interactive features of the game (puzzles and activities) tend to be simple, point-and-click manoeuvres reminiscent of 'first-person shooter' games. In themselves, they bear little relation to the issues that the context of the game addresses, and require only





trivial kinds of decision making on the part of the player. In the end, these limitations mean that the game's efforts to educate tend to drain most of the fun out of it and fail to do much educating through the gameplay itself.

*Syberia* is a very different kind of game, a commercial adventure game, but it also fails to reflect many of the guidelines suggested above. This game was hailed upon its release for its stunning graphics and its more complex storyline. These aspects of the game are apparent, but graphics and story cannot substitute for challenging gameplay, and this is not well-developed. The NPCs in *Syberia* take a long time to reveal any useful information – usually a tedious random searching process reveals it before they do. Thus, the mentoring process discussed above, which should occur through distributed knowledge and just-in-time delivery of information, is lacking. Further, great amounts of time are spent wandering back and forth across the same stretches of road, trying the same locked doors, dead ends, etc. This violates the principle of keeping players working at the outer edges of their competence and generally fails to engage players in an active thinking process.

*Tony Hawk's American Wasteland* lies at the other end of the spectrum. Almost immediately, one sees the learning principles we have been discussing embedded in this game. *Tony Hawk* starts out with a scene where the player chooses which character to play (out of several young teenage boys). That character then hops on a bus to LA (where skateboarding 'rules'), gets off the bus upon arrival in the city, and promptly gets mugged (but not too badly!). A friendly and streetwise young woman walks up and befriends him, trying to clue him in to the fact that if he'd get some cooler clothes he wouldn't stand out as so much as a 'loser' (and, therefore, a target), and she points out the clothing store across the street. The player goes in and chooses a new outfit; upon arriving back on the street he sees another NPC expertly performing a beginning level skateboarding move. The friendly young woman walks up and introduces the player to the 'expert' who offers to show the player how to do the move. This sequence, and many others like it in *Tony Hawk*, provide superb examples of the mentoring process discussed above. Knowledge is distributed between various NPCs and the player, and information is 'fed' to the player in small amounts at just the point that it is needed to progress further. This mentoring takes place largely through showing rather than telling, and keeps the player engaged in trying out new tasks or honing better skills, thus operating at the outer edges of their competency. As a result (and unlike *Food Force* and *Syberia*) the game is fun, and holds the attention of players for hours.[2]

The final example reviewed here represents a somewhat different genre. The hugely popular *World of Warcraft* is the most successful example to date of a 'persistent world'. What this term means is that the virtual world created in the

game is available on the web 24/7, and it continues to evolve even when an individual player is not 'in-game'. These worlds are large, immersive environments. They are populated by a great variety of NPCs, as are many conventional video games, but they also are populated by a great variety of *other players*, often from around the globe, with whom one is able to communicate through an IM type of chat. Thus, this innovation in video gaming creates unprecedented opportunities for social networks and interaction, both competitive and cooperative, among players. The latter characteristic is part of why these games are of great interest, not only to players but also to academics and others, who see in this technology unprecedented opportunities for research, particularly in the social and behavioral sciences. *World of Warcraft* is widely hailed as the most impressive achievement in this area and has experienced tremendous growth since its release in 2004. It also illustrates some of the guidelines for an effective educational video game discussed above. The degree of immersion and interaction provided in the world is unsurpassed, and the player attempting to accomplish various quests assigned to them by the NPCs receives constant feedback, both from the game's artificial intelligence and from other players. In general terms, the educational opportunities offered by this technology are quite promising, as, ideally, students in a class could meet in the world and carry out tasks as a team or in competition with one another. Such promise is not likely to be realised in *World of Warcraft*, as it does not offer the opportunity to create whole new scenarios (as do some of the previously mentioned modding tools), at least not at present. However, other persistent worlds are being introduced that address this deficiency, such as *Second Life*. Indeed, the research potential of such games was recently highlighted in an article in *Science* authored by an NSF program officer (Bainbridge 2007). While it is too soon to say how successful such games will be in the educational arena, they appear to hold great promise and should be monitored closely for future developments.

## The journey begins: designing a game for teaching economics

In the interest of exploring the learning potential of video games (and putting the ideas reviewed in this paper to a test), the authors began developing a game entitled *Journey to Akerloff* for use in Principles of Microeconomics. A modding kit known as the *Aurora Toolset*, which is packaged along with the popular role-playing game *Neverwinter Nights*, was selected to provide the game engine. This choice was deemed advisable partly because it is the software that was selected by the most high-profile academic video game project to date, *Revolution*, the game developed by researchers at MIT to teach American history to K-12 students. It also is very inexpensive, runs on machines without high-end video cards (or speed), is relatively simple to learn and use, and has the support of numerous online forums and tutorials provided by the manufacturer and the gaming community.





Our objective was to develop a simple storyline within which we could try to bring to life concepts that often simultaneously baffle and bore beginning students: 'diminishing marginal utility', the 'equimarginal principle of utility maximisation', 'total and marginal physical product', the 'profit-maximising level of output' and the like. The idea is that a module will be constructed to accompany each cluster of chapters covered in a standard microeconomics course and, taken together, these modules will comprise an adventure story. The basic setting of the module is a medieval woods and village under siege by an unspecified enemy. The player immediately encounters a situation where he/she must attempt to rescue family members who have been kidnapped, and in the process must buy supplies, work in a mine, manage a cottage industry and so forth. The setting, characters and so forth are constrained somewhat by the medieval theme of the original game, but there is still great latitude for developing an interesting and appropriate plot, characters, puzzles, etc.

We completed the first module, which is suitable to accompany a typical chapter on 'consumer theory' in a first-year, university-level course in microeconomics. We then subjected it to preliminary testing by assigning the module for 'extra credit' in a four-week summer school course. The feedback we received from students suggested that (1) students are very receptive to such an approach and are enthusiastic in their preference for games over text or lecture, but (2) they need more direct instruction on navigation within the game itself than we had anticipated, and (3) they are quite diverse in terms of their comfort with computers and/or their confidence as 'gamers'.

With regard to the first point, our experience concurred with that of others (see for example, Squire 2005) in that the most enthusiastic players were generally not the strongest students – those for whom traditional methods were working well – but rather students who might otherwise turn in a lackluster academic performance at best. The limitations indicated in the second and third points led us, subsequently, to develop an introductory instructional module that takes students about 30 minutes to play through in order to familiarise themselves with the game controls and learn how to play the game. In our preliminary results, adoption of this module has produced highly favorable student responses, suggesting that these issues may not pose the obstacles to the implementation of a video game teaching tool that we encountered in our first tests of the module on consumer theory.

## The journey continues: guiding students in designing a game for teaching economics

We developed the second module of *Journey to Akerloff* using an entirely different process. Our university annually conducts a 'Summer Research Institute' (SRI) which

provides opportunities for teams consisting of two undergraduates and one incoming freshmen to work on an applied research project with faculty members in their areas of expertise. We were approved under this programme to work with a team of two senior economics majors and an incoming freshman interested in the field to create the second module in the teaching game. We hypothesised that such an approach would capitalise on the interests and aptitudes students already possess, either as a result of their experience playing video games, or simply from exposure to gaming as a part of the cultural milieu in which students now grow up. The students in the summer research project were charged with the development of the second module, 'J2A2'. This segment was envisioned to accompany chapters on the theory of the competitive firm. To get the students up to speed on the educational themes behind the project, their first assignment required that they digest material from a couple of papers on learning and video games and from literature on game design. They also watched a webcast of economist Edward Castronova, whose work was cited earlier, presenting at a conference on the future of video games in education. Their second assignment required that they work through a comprehensive tutorial on the use of the Aurora Toolset, available on the Bioware website, and then that they play through the first module we had developed ('J2A1'). They were then ready to begin work on the development of J2A2.

The instructors provided the students with an outline of the basic storyline and some possible twists and turns in the plot that might lend themselves to portrayal of productivity relationships, the cost curves and profit maximising behaviour. The students were then set free to work collaboratively in refining the plot, choosing settings, developing characters, composing dialogue and inventing puzzles that could be incorporated into the module. This sequence of activities extended through a seven-week period. During the eighth and final week of the summer session, the students were asked to submit written reflections on their experiences during the project. They also decided how to go about presenting the module to the university community at a formal symposium that is held at the end of the summer concluding the Summer Research Institute. Lessons learned from this experience – by all of us – are reviewed in the remaining section of the paper.

## Student insights, teacher insights

The students succeeded in completing the module in the time allotted for the project (no small feat) and seemed to take pride in the final outcome as they presented it to other students, faculty, community members and administrators at the Symposium. Their reflections on the experience suggest that they learned a lot about economics and about teaching, but also that some aspects of the experience had been a bit daunting. A sampling of their comments is reviewed here. All three of the students





seemed to feel there were important advantages to a video game's ability to portray economic concepts as opposed to traditional classroom presentations:

> '…video games have the potential to engage a student in a subject in ways that are unachievable in the classroom. That is, if the game is done right.'

> '…I feel like the application of new material is the best way to learn something and retain the information. The study of economics is very simple but some of the technical information can get difficult, for example, graphs. If a student is able to take the information that the graphs have and apply them they would have a better understanding of the shapes and properties of the graphs. Video games could allow students to do this because time is not an issue in the virtual world like it is in the real world. In video games students could see the effects of the decisions they make….'

> '…the 'just in time' delivery of information to the player would be a strength that video games have over classroom settings, as bits and pieces of information are given to the player for application to the virtual world. In contrast, school settings have hardly any practical application of various academic concepts to the real world. I think the strengths of video games as an educational source far outweigh any weaknesses.'

The students seemed to feel that the experience helped cement their understanding of economics and provided important – perhaps surprising – skill development:

> '…I had a great refresher course in principles of economics, learned a lot about programming and even more about analytical and critical thinking. I entered the project basically a complete novice……and had to learn very quickly how to use the tools in the game to make things work. Also without much guidance I would have to find things out by doing additional reading and send emails to different people that build video games. I feel as if the experience helped me in preparing for my career, because when I start my first real job, I probably will not have a clue on what to do and will need to find out how to get the answers that I need.'

> '…When creating the game I wanted things in it that I would have liked…. There would have to be problems but they would have to be inside of the story. Trying to introduce the problems in this manner forced me to know the material that I was trying to get across inside and out. As I entered new tasks into the game I was learning as well. Prior to the project I felt like I had a great understanding of the principles of economics but as we progressed I found myself looking back over old material to make sure that I was not

making a mistake. Even when I did make a mistake I had the opportunity to learn from those. In the two months of the project I think I gained a greater knowledge of the material than I had before because now I had to apply what I knew. It reinforces the theory that you have a better understanding of things when you have to actually use them.'

While the students felt they learned a lot from the experience, some aspects of the project appeared to have been a bit daunting:

'…the subject being taught must be imbedded in the mechanics of the game. This requires complete mastery of the tools and the subject being taught. I had neither.'

'…I had to thoroughly grasp fundamental concepts of microeconomics, such as profit-maximization, in order to know how to better incorporate such concepts into a fun as well as educational excursion for the player. One thing I have learned in my efforts to create such an excursion is that the player can become bored with their virtual journey if they are overloaded with too much information at once….'

'…Being a player of educational games is so much easier than making them. Just like being in a class is easier than teaching one.'

This experience was also a novel one for the instructors. We had great faith in the creativity of the two economics majors chosen for the project, and were also confident of their ability to take the initiative and work independently. They did not disappoint. However, the same thing could not be said of the youngest student involved in the project, that is, the incoming freshman. One lesson learned, therefore, is that this type of project may be most appropriate for students with more college-level experience and, perhaps, more maturity than the typical new freshman on campus possesses. A second lesson is that even experienced, self-directed learners may be uncomfortable with the perceived need to get up to speed in a variety of areas so quickly, and with the concomitant need to set to work prior to a more complete mastery of the necessary skills and knowledge that this project entailed. While these elements definitely caused some discomfort, we are not convinced that they were, on balance, a negative aspect of the project. Rather, we believe that this type of experience – one in which, in Gee's terms, students experience 'performance before competence' – provides a powerful mode of learning, and one that is clearly consistent with the emerging pedagogy of video games.

A final lesson we carried away from this experience was how important are the communities that tend to build around video games, both in terms of game play





and in modding. The student creators on our project reported being frequent visitors to the extensive online forums on the Bioware website. These forums are communities of players who, together, explore and share their knowledge of the game play, of their own experiences in modding, and of the capabilities and frustrations associated with the modding tools. These online resources were invaluable to our students in their individual efforts to contribute to the project. In addition, the community that formed among our three student collaborators themselves was indispensable in giving them the confidence to follow through on the project. Should we undertake a similar project in the future, we would definitely attempt to extend further this aspect of the student experience.

The technical side of this type of project can be problematic, if computer labs are poorly equipped and/or if participating students do not have access to internet capabilities or adequate computers in their homes. On the other side of the coin, however, some of the coordination issues turned out to be much easier to handle than anticipated, thanks to the ability of all participants to upload and download successive variations of the game to a common file accessible to all on the university's server via the internet. The truly tough issue that presented itself had little to do with equipment and computers but everything to do with the pedagogy of the project itself. The question of how, genuinely, to 'show, not tell' the economics lessons in our story remains something of an open question. This, in our assessment, is the greatest challenge of developing a truly effective educational video game for the teaching of economics. Our experience with the summer project suggests, however, that the insight and creativity provided by university students, the 'digital natives', may provide a potent and readily available resource to deploy in this development process.

## Concluding remarks

The use of video game technology in the classroom, particularly in a manner that preserves the fun and the superior learning theory embedded in commercially successful video games, is long overdue. Many developments of the past few years suggest that the time is right for the successful implementation of this technology in the academic setting. The mutually reinforcing trends in IQ scores and popular culture reviewed in the first part of the article suggest new opportunities for engaging students. The variety of organisations and funders eager to experiment with new applications in this area has never been greater. And the scholarly work on learning and video games is rapidly closing gaps in our understanding and providing a solid base from which to apply the lessons garnered by the video game industry over the past two decades. The immersive and interactive potential of video games suggests that authentic experiences that simultaneously entertain

and educate are within the reach of students from kindergarten to college. The work reported here, developing video game modules to assist in teaching microeconomic principles, illustrates one method by which this potential may be realised through the efforts of individual instructors. Clearly, as experimentation proceeds, some efforts will outshine others and, eventually, mods will emerge that are of sufficiently high quality to be distributed as ancillaries for adoption widely. Alternatively, instructional middleware may develop sufficiently rapidly to produce tools by which individual instructors can customise a standard set of materials with minimal effort. Whatever the eventual outcome, we believe – and we hope we have demonstrated – that the opportunities for useful experimentation in this arena are already a reality, and that more can be accomplished, even with minimal institutional support, than is commonly recognised.

## Notes

1 Reverting to the idea of a single manifestation of intelligence is appealing in that there is a fairly high degree of correlation between the two – people good at deduction are often good at induction as well. But, while it is true that these two types of intelligence are correlated, fluid intelligence and crystallised intelligence can be distinguished psychometrically. As an example, the high IQ societies have found it necessary to decide which type of intelligence they use when deciding to whom to offer membership. When Mensa went through that exercise, three out of four people who were sufficiently exceptional in fluid intelligence to qualify for membership would not qualify using crystallised intelligence tests and vice versa. Mensa, Intertel and ISPE have chosen crystallised intelligence measures for membership, while Four Sigma and Triple Nine selected fluid intelligence measures (Towers, 1988).

2 An interesting and entertaining portrayal of the learning involved in *Tony Hawk* appears in a paper by Elizabeth Hayes (2007). Hayes' work, like that of James Gee, David Shaffer, Kurt Squire, Constance Steinkuehler and others at the University of Wisconsin-Madison has been particularly valuable to the authors in articulating the pedagogical significance of video games. This group of researchers collaborates and publishes or hosts conferences and workshops that disseminate some of the most insightful research on video game pedagogy.

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# A New Keynesian Workbook

*Pavel S. Kapinos*

## Introduction

Over the past couple of decades a large body of literature analysing the business cycle fluctuations has employed the New Keyensian models. This framework introduces the traditional Keynesian emphasis on the short-term price stickiness into the neoclassical paradigm that features dynamic optimisation and microfoundations. Thepresent paper builds on recent pedagogical literature that introduces the New Keynesian framework into undergraduate economics curricula by considering several versions of the standard New Keynesian model and by describing an Excel-based application that facilitates learning the internal logic of these models.

A large body of recent pedagogical literature has suggested alternatives to the traditional Keynesian IS/LM–AS/AD framework. Colander (1995) discusses the analytical gaps in the standard AS/AD model. Taylor (2000) and Romer (2000) point out that modern central banks do not target money supply but interest rates and replace the price level with inflation in the AS/AD model. Walsh (2002) emphasises the fact that central banks do not set their interest rate targets exogenously but, to a large extent, in response to inflation and he modifies the analysis to account for the fact that output needs to be normalised by its natural level. Carlin and Soskice (2005) and Bofinger *et al*. (2006) build on this work to present extensive graphical apparatuses for the analysis of models related to the baseline New Keynesian model that describes the interplay of inflation, output gap and interest rate. Guest (2003) and Turner (2006) suggest different modifications of the model that improve its pedagogical accessibility. Finally, the model has made solid inroads into undergraduate textbooks: Stiglitz and Walsh (2002) and Taylor (2007) emphasise inflation targeting at the principles level using graphical analysis whereas Carlin and Soskice (2006) and Jones (2007) provide an extensive treatment of a dynamic New Keynesian model at the intermediate level.

This paper complements existing pedagogical work by providing an easy-to-use Excel-based interface where students can develop intuition about the model by