The Motivation of Gameplay
or, the REAL 21st century learning revolution

By Marc Prensky

[5639 Words]

When I watch children playing video games at home or in the arcades, I am impressed with the energy and enthusiasm they devote to the task. … Why can't we get the same devotion to school lessons as people naturally apply to the things that interest them?

– Donald Norman, CEO, uNEXT [1]

One of the biggest problems in *all* formal learning, whether classroom, online, distance, or "e-," is keeping students motivated enough to stick with the learning process to the end of anything – a class, lesson, session, course, semester, or degree.

Why is motivation such a big problem? Because all learning requires effort, and, like crime, people rarely do it without a motive.

What motive – or motives – *do* our higher education students have for learning the material presented to or required of them? There is, of course, the pure joy of connecting with the ideas and material. Unfortunately, this happens much less frequently than many educators would like. More generally, students' motives for learning are a mixture of intrinsic goals and extrinsic rewards, combined with psychological factors such as fear and need to please. If strong enough, these motives can and do pull students through to the end. We, at least, all "made it through" our own post-secondary schooling.

But how effective will these forms of motivation be in the future? We live in a time when long-range goals and promised rewards are a whole lot less certain and therefore less motivating than they used to be.

In the world of education, providing motivation has been one of the teacher's traditional roles. Teachers are often evaluated and remembered by just how good motivators they are or were. And whenever there is a teacher, this should never stop being the case.

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But wouldn't it be nice if the process *itself* could also motivate the learner? Even if the teacher weren't there?

How motivating is the *process* of higher education in today's environment? How many of our college students get up, go to class, do a project, study, or take an exam because they *want* to and *look forward* to it? Sure, there is the occasional professor whose classes are so entertaining that you wouldn't want to miss one. But mostly the "curricular" part of college is *painful*, and often *drudgery.* Unlike the extracurricular part, it's not something one would usually classify as "fun."   And most college teachers – and administrators – would not only agree, but think that this is a good thing.

But is it?

Contrast this, if you will, with games, particularly computer and video games. While game players clearly have longer-term goals (e.g. beating the game and/or fellow players around the world) and games also offer rewards such as scores, prestige, and prizes, it turns out these are *not* the principal reasons people play games. People play games because *the process of game playing is engaging*. In fact, the top two reasons people say they play interactive games, according to the Interactive Games Association, is because they are challenging and relaxing. This formulation seems very close to that magical state of motivation some refer to as "flow."

And motivating it is. I hear regularly from many sources that college students devote a huge proportion of their time to playing computer and video games, often rivaling – and in extreme cases exceeding – the time they put into their studies. (Unfortunately I have seen no specific research data on this – have any readers?) I know several universities, colleges and at least one medical school have seen their networks slow to a crawl or break down because of student on-line gaming. And one online game popular among college students, *EverQuest*, is jokingly known as "EverCrack" because of the amount of time its "addicted" players spend using it. And that's just online – our students spend large amounts of time playing off-line, alone or with others on a single console. One college student recently confided to me he had skipped an exam because he was so close to "beating" a video game.

So we might want to investigate *why* the process of learning is often so painful while the process of game-playing is generally so engaging. Does this *have* to be the case? Most importantly, what can learn from the motivation of games that will help us with motivation in education?

Computer and video games are so engaging – and education is often so *un*engaging – *NOT* because that is the "natural state of things," or "the nature of the beast." Although many hold the opinion that "learning hurts" and "games are fun," any of us easily can think of enough counter-examples to prove this isn't a universal truth.

The reason computer games are so engaging is because *the primary objective of the game designer is to keep the user engaged*. They need to keep that player coming back, day

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after day, for 30, 60 even 100+ hours, so that the person feels like he has gotten value for his money (and, in the case of online games, keeps paying.) That is their measure of success.

The goal of keeping users (i.e. learners) engaged is, of course, *not* the primary concern of educators. The primary goal of educators is to instruct, i.e. to get the material across. Learners are typically trapped, either physically in a classroom, or by their goals. Although some small effort may be put toward engagement, if the learning process is a painful one, well, tough.

But are the goals of rigorous learning and having fun incompatible and mutually exclusive? I think a great many academics believe this, and resist any efforts to make learning fun, passing the same pain down, generation after generation, as an academic "rite of passage" (How painful was *your* PhD?)

Must we accept this? Does it have any basis in fact, or is it merely tradition? More importantly, will our students continue to accept it? Society has finally begun to outlaw painful things associated with education, such as beating and hazing. What if we were to outlaw "painful learning" as well? Of course we dare not, since our educational institutions would quickly be put out of business!

And online it's worse. Despite education's new availability over the Internet, and even though people are often *paying* for it, completion rates are often less than 50 percent. Most "e-Learning" is *more* than just soporific, it's downright torture!

To the detriment and dismay of learners, a vicious cycle is happening in which schools are convinced that this awful type of "education" is OK and are rushing to offer more of it. Even when an institution or vendor boasts that they add "doing" to the mostly reading and electronic page turning of online courses, they are not making the process "fun." Any comparison with what is *actually* fun online (i.e. games) would show that online education has merely taken to heart former Apple evangelist Guy Kawasaki's saying, "Don't worry, be crappy!"

Allons enfants de la patrie

But I predict this will change, and in a major way. For as the need for learning that people *actually want to do* becomes more critical, and as academic instructors and institutions finally confront the fact that the generations who love to play computer and videogames – to the tune of almost $20 billion annually worldwide – are also their students, the learning process stands at the beginning of a huge revolution.

Yes, we've heard this before.

But in my view the learning revolution is *not* – despite what many preach – the shift in course delivery to the Internet, although that is important and transformational. It's *not* "distance learning," although that, too, is an important part of the process. It's *not* just

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more, faster, smaller computers in college classrooms, dorm rooms and in students' palms. It's not wireless, or broadband, or just-in-time, or learning management systems. And it's *not* computer-based, or "e" learning.

The TRUE 21st century learning revolution is that learning is finally throwing off the shackles of pain and suffering that have accompanied it for so long.

I am certain that within most of our lifetimes pretty much *all* learning will become infinitely more learner- centered and fun; fun for students, for teachers, for parents, and even for supervisors and administrators. The huge wall separating learning and fun, work and play for the last few hundred years is beginning to tremble and will soon come tumbling down. And though the barrier may continue to resist for a while yet, as with the Berlin Wall in the political world, when it finally does fall there will be a huge stampede to freedom.

The *reason* this will happen, and happen soon, is because *learners will demand it, to the point that teachers and administrators can no longer resist*. Students who spend so much of their time playing rich, fun and engaging interactive games will no longer accept or do learning that is painful and boring. And as the military and many businesses have already found, to get these students involved in learning we have to inject fun into the process.

And the really good news is that they are discovering – to the amazement of many, although certainly not students – that adding fun into the process makes learning not only more enjoyable, compelling, but more effective as well. When the Navy recently turned a periscope simulation into a missile shooting game, engagement *and accuracy* also shot up. [2]

Fun : The Great Motivator

So where does the dialectic between fun and learning come from? Are the two related? Must they be separate? These are not easy questions to answer, because we actually know very little about either!

What *is* "fun," anyway?

There is surprisingly little research on this topic, although there is much on play and games. Some of this may be due to the fact that, at least as far as Johan Huizinga could see in his major work on play, *Homo Ludens* [3] , no language other than English has an exact equivalent of the word "fun."

The Oxford English Dictionary [4] defines fun as:

1. A cheat or trick; a hoax, a practical joke
2. a. Diversion amusement, sport; also boisterous jocularity or gaiety, drollery. Also, a source or cause of amusement or pleasure.
   b**. to make fun of, poke fun at** (a person, etc): to ridicule. **For or in fun**: as a joke, sportativly, not seriously. **(he, it is) good, great fun**: a source of much amusement.

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> ***Like fun***: energetically, very quickly, vigorously. ***What fun!:*** how very amusing
> 1 ***for the fun of the thing***: for amusement; to have fun with: to enjoy (a process); spec. to have sexual intercourse.
> c. Exciting goings on. Also ***fun and games***, freq. Used ironically; spec. amatory play. Colloq.

Microsoft's Encarta World English Dictionary [5] defines fun as:

> **1. amusement:** a time or feeling of enjoyment or amusement. *Just for fun, we wore silly hats.*
> **2. something amusing:** something such as an activity that provides enjoyment or amusement. *Skiing is fun for the whole family.*
> **3. mockery:** playful joking, often at the expense of another. *What's said in fun can still hurt.*

So we begin with a major duality: Fun is amusement, but it is also ridicule, a cheat or trick, or even sexual. Of course no educator wants his or her learning to be "ridiculous," "sexual," or even just "amusing."

But there is another, far more relevant and important division. The above definitions lump "enjoyment" and "amusement" into the same category. I am sure this is wrong, at least in terms of the modern use of the word "fun." And this is what leads us to confusion and conflict.

For while *amusement* may, in fact, be frivolous, *enjoyment* and *pleasure* are certainly not. We enjoy and take pleasure from many of the most serious things in life – our families, our passions, our work. The enjoyment, pleasure or "fun" we derive from these activities is the principal source of what makes us return to do them again and again — and there is increased "fun" because the more we do them the better we get, the easier they become, and the more goals we can achieve. Among the collection of "fun activities" listed in an article by Pierre-Alexandre Garneau on the Gamasutra.com web site are Beauty, Immersion, Intellectual Problem Solving, Competition, Social Interaction, Love, Creation, Power, Discovery, Advancement and Completion, and Application of an Ability. Does any of this sound frivolous?

Fun in this positive sense can include real physical and mental exertion, as in sports or other competitions. In fact, the MIT Media Lab characterizes their approach to learning as "hard fun." [6]

So "fun" can connote both enjoyment and pleasure (good), *and* amusement and/or ridicule (bad). This dichotomy lies at the root of many educators' resistance to new learning approaches based on any connection to fun (and, by extension, to play and games). In some respects it's only a matter of semantics, but with important consequences. Proponents of "fun learning" relate fun to enjoyment and pleasure. Opponents relate fun to amusement and ridicule. They use the same word but don't speak the same language.

Now – dare I ask – what is "learning?"

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Although the dictionary definition, "gaining knowledge or understanding of, or skill in, by study, instruction or experience," is a simple one, what *actually goes on* when "learning" takes place (and how we even know for certain when it does) is still largely unknown and often hotly debated. Dr. Greg Kearsley's *Theory in Practice* Web site (http://tip.psychology.org/index.html) summarizes 50 "major" learning theories, and readily admits that it is not exhaustive, with entire categories, such as the philosophical and neuropsychologoical theories, omitted.

The lack of a clear physiological definition for "learning" is a major barrier preventing education from making progress, and I plan to return to the topic of "What is Learning" in a future article. But for now it can be accurately claimed that the meaning of "learning" is sufficiently unclear that it is not possible to exclude "fun," (in the sense of enjoyment) from the process. In fact, neuroscientists are finding that the same pleasurable brain chemical – dopamine – produced when taking drugs like amphetamines is also intimately involved in the learning process. (Anyone else remember taking amphetamines to study better?)

Fun and Learning

Without being able to define either "fun" or "learning" specifically, can we say anything about the *relationship* between them? Does having fun hurt learning, or help it?

Some researchers have looked at this:

> "In simple terms a brain enjoying itself is functioning more efficiently."… "When we enjoy learning, we learn better" (Rose and Nicholl, 1998) [7]

> "Enjoyment and fun as part of the learning process are important when learning new tools since the learner is relaxed and motivated and therefore more willing to learn." … "The role that fun plays with regard to intrinsic motivation in education is twofold. First, intrinsic motivation promotes the desire for recurrence of the experience…Secondly, fun can motivate learners to engage themselves in activities with which they have little or no previous experience." (Bisson and Luckner, 1996) [8]

> Bisson and Luckner also cite Middleton, Littlefield & Lehrer, 1992; Datillo & Kleiber, 1993; and Hastie, 1994; as concluding that fun increases learners' motivation. [9]

So fun in the learning process creates relaxation and motivation. Relaxation enables learners to take things in more easily; motivation enables them to put forth effort without resentment. Given this, it certainly makes sense that fun and learning should go hand in

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hand. "Anyone who makes a distinction between education and entertainment," observed Marshall McLuhan, "doesn't know the first thing about either." [10]

Yet a great many academics still maintain the opposite. "Education is not fun," says Yale Professor David Gelernter in a recent *Online Learning* interview. [11] "Most learning isn't fun." writes Clifford Stoll, who teaches astronomy at U. C. Berkeley [12]. Are these professors merely telling us that learning and education are not frivolous, or are they actually saying that we must deliberately keep out any enjoyment? Both Gelernter and Stoll prefer to characterize education and learning as "hard work." Perhaps this is why one game developer I know describes the principal contribution of academics in developing online learning as "sucking the fun out."

The relationship between learning and fun is, in fact, a complex one for academics. Although most professors would no doubt say "My subject is fun for me" (often with "So how could it not be for my students?" strongly implied) a great many of them still – and probably at the same time – relate learning *not* to fun but rather to its opposite, pain. This point of view is well expressed by Benjamin Franklin's aphorism: "Things which hurt, instruct."

Dr. Sivasailam Thiagarajan (aka Thiagi) has researched this issue, and thinks many people *want* learning to be painful. "If you look universally at every language, every culture has the equivalent of 'no pain, no gain' as a proverb. I think it's partly due to the survival need of human beings that usually suffering results in learning. Unfortunately, human beings took the *converse* of this also to be true, that is to say, if you don't suffer you're not going to learn." [13]   In this widely-shared view, learning *can't* be fun in the same way that pain can't be.

Learning Shackles

Yet there is no theoretical or practical reason why this converse should be true. In fact, it is patently *not* true. People, starting as babies, learn all the time without suffering. Sure, it hurts to touch a hot stove and get the painful lesson not to do it again. But does it hurt to say "dada" and get a huge smile, hug and kiss as a reward? So while we do learn from pain, learning doesn't have to be painful. Such ideas are counterproductive "learning shackles" in today's world, and educators should throw them away.

To further complicate matters, there is a strong religious tradition involved. Remember how happy Adam and Eve were before they ate the fruit of which tree? In the extreme biblical view, knowledge is the cause of all man's suffering. All learning is painful, knowledge is sin, and learning is merely a form of suffering. Remember that for thousands of years the church controlled schools and learning. Many of its precepts still live on in the minds of educators. Although religious thought has many positive things to offer us, the links between knowledge and evil, fun and sin are not among them. It is certainly time to throw out these "learning shackles" as well.

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Mixing learning and fun may also be inhibited by another concept with religious overtones – the so-called "Madonna/whore" complex, whereby people do not want to mix the "pure" with the "unholy." Anyone who sees "learning" as serious, and "fun" as frivolous or sinful is experiencing this quasi-religious double standard.

So, for all these reasons and more, learning and fun have for the most part been kept far apart in the minds and practice of most post-secondary educators.

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But you may be saying to yourself "Wait a minute – We all know that fun is a part of motivation, and every teacher tries – as best as he or she can – to inject some "fun" into his or her teaching."

Really? A former college student told me recently that he had attended a highly ranked school where the instructors were all from MIT. "All they did," he lamented, "was read from their textbooks."

While we cannot know the precise extent to which fun and learning are mixed inside the college classroom, online courses are exposed for all to see. And although the online learning we have today may be acceptable from a *content* perspective, it is almost entirely lacking from the point of view of fun and motivation.

Gameplay

Which leads me to a perhaps unfamiliar word: "Gameplay." Remember, game designers focus primarily on motivation; educators don't. The most important thing that educators can learn from game designers is how they keep the player engaged. ***Gameplay is all the activities and strategies game designers employ to get and keep the player engaged and motivated to complete each level and an entire game.***

Of course, not all college teaching can or should be done through games. But many concepts and approaches that are second nature to game designers – yet for the most part foreign to educators – can teach us how to create more fun, engaging and effective education.

Gameplay versus Eye Candy

How? A game designer sitting down to create a game has two main tools. Most obvious to a non-player are the graphics – the stunning visual representations of what the game is about and the increasingly lifelike representations of the game's characters. This lush world of 3D animation and video is known in the games business as ***"Eye Candy."*** Rapid advances in technology have been increasing developers' ability to create realistic and impressive Eye Candy at an incredible rate. Each new, more powerful game console that comes out raises the Eye Candy "bar" higher – in the latest sports games it is hard to say

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whether you are watching a game or live TV. Creating this level of Eye Candy consumes the major portion of the average consumer video game's $3 million - $6 million budget.

But as good as Eye Candy is or may become, it *not* what great games are about. While state-of-the-art Eye Candy may be a necessary condition in the commercial marketplace, it is never, by itself, a sufficient condition for a great game.

Great games are about *Gameplay.*

Gameplay is all the *doing, thinking* and *decision making* that makes a game either fun, or not. In a puzzle game, the Gameplay is the physical and mental activities in the puzzles. In a shooter, it's the player's and the opponents' speed and abilities. In a strategy game it's the available options and tactics. Gameplay includes the game's rules, the various player choices, and how easy, gradual or hard or the road to success is.

At its core, Gameplay addresses the question "Is what I'm doing fun pretty much all the time I am doing it?" It includes not only providing engaging activities, characters and situations, but also balancing and constantly adjusting the game so that it continually keeps the player in the "Flow Zone." One basic rule of good Gameplay, for example, is to always provide the player with clear short-term goals. Another is to make the game easy to learn, but hard to master – think of Chess, or Go.

How does Gameplay create motivation?   By *keeping the player engaged at every moment*. It makes *every second* (or nanosecond in some cases) of the game a challenge – physically, intellectually, and/or emotionally. And it is this *continuous challenge* – at the precise context-and-user-appropriate level – that motivates.

Gameplay and Education

How can we bring more Gameplay – continuous, appropriate challenge – into the educational process? If we make it our goal, we can easily insert Gameplay into almost everything we do. Want to add Gameplay to a lecture? – just add uncertainty. Begin the lecture by telling people that some of what they are about to hear may not be true. Harvard Professor Ellen J. Langer [14] discovered that when faced with uncertainty, students spend the time actively trying to sort out what is true from what isn't, and are more engaged, with greater retention. Want to add Gameplay to a textbook? Langer has done experiments with inserting "conditional" language. My own recent book contains frequent "contests" asking readers to e-mail their own answers, perspectives and examples for sharing, recognition and prizes.

In fact, once one begins thinking about learning from the Gameplay point of view, there is no end to the ways one can inject more Gameplay – *active engagement at every second* – into traditional education. These range from uncertain outcomes (in business school one professor offered a choice of either separate grades for each semester, or the second semester's grade for both), to adaptive testing, to contests, competitions, and even Socratic dialogs. Although some of these things are done today by some professors,

suppose all instructors were *required* – or, better, incented – to think not only about organizing their material coherently, but about injecting the maximum Gameplay into it as well?

One place where Gameplay is almost entirely missing is in the online courses being offered today by academic institutions. Most of these are deadly dull "page turners" with tidbits of generally boring "interactivity" and rudimentary Eye Candy. The principal reason that our academic online learning is so bad is that *it has NO Gameplay*. Remember, good Gameplay requires that *every second* of the experience be engaging – even the reflective parts (think about choosing a chess move.) I truly think this is achievable in online education. But the goal has yet to be fully realized.

What will higher education – especially online education – be like when it is?

When the Higher Ed World Becomes Like the Games World

Today's video game world provides a highly probable end-state – a totally user-centered environment – of what higher education may evolve to look like. In order to give you a sense of such a learner-centered environment, I will describe three aspects of today's games world, and invite you to make your own leap to future education. (Note: I just added Gameplay.)

I will portray in turn three worlds: those of today's game player, game designer, and game seller.   These correspond roughly to the learner's, teacher's and vendor or publisher's worlds in the education arena.

World #1: The Player

If you are a game player today, lots of people are courting you. They are trying to get you to spend your money for *their* game, and they know they have to work hard to do it. They bombard you with advertising and information. They package their products in an appealing way. They provide free demos via Web downloads or bundled into your favorite magazines.   They feed you advance information about each game in development, and you anticipate new ones for months. You upgrade your equipment just as often as you can afford to.

You are not limited to the offerings of any one publisher or developer. Within each particular genre you pick whatever variation you like best, searching continually for more fun and harder challenges. There is information galore about these products at your fingertips to guide your choices. More than a dozen paper-based magazines, and an equally large number of Web sites, provide you with reviews of every game with star-based ratings, side-by-side comparisons, chats with other players, previews of games in development, interviews with creators, tricks, codes, cheats – anything you might need to know to make an informed choice. You also have tech support, which is essentially unlimited coaching about how to install and use the game.

You expect an awful lot from your games. You expect each new game to be better than the last one you played — better Eye Candy, more complex AI (artificial intelligence), and more exciting Gameplay. You expect it to be networked more cleverly. You expect the learning curve to be progressive and easy, and for the game to keep you "in the zone" for its entire life. You expect to receive upgrades, patches, and even unexpected surprises from the publisher. You expect the game to give you *at least* 30 and maybe even 100 hours of play and fun. You expect it to be part of a series, so you can go on to more challenges when you finish.

What if all this were true for higher education courses?

World #2: The Designer

As a game designer, you're focused totally on engaging your audience. "How can I keep a maximum number of players on the edge of their seats for hours and hours?" is the problem you're working to solve. You give continuous thought to the kinds of interaction the player will have with your game – its Gameplay. You work hard to introduce everything about the subject and content of your game via the action, with an absolute minimum of telling (gamers hate telling).

You are always trying to improve your game, to do something new and innovative, to push against publishers demands for clones. You are trying to design something that *you* would want to play and that you would want all your best friends to play with you. You strive for an experience that that will cause people to actually leap out of their seats saying "Man, is this cool," and run out to call all their friends. And you are constantly testing your effectiveness as you create, asking both your buddies and professional game testers (all avid players, many under 14) to tell you just how much fun it is or isn't and what parts need to be improved – made more fun – before you dare release it. Even after its release, you are constantly putting up new levels and challenges, and encouraging players to do the same.

What if designing curricula and courses were approached in the same way? Wouldn't it be a lot more fun and interesting for students and instructors?

World #3: The Seller

If you publish games, you are always thinking about your audience. What do they like? What experiences can you give them that they haven't had or can't get elsewhere? What additional aspects of the players' lives can you relate to with a game? How fast can you incorporate the latest technologies? In short, what will *sell your games to the player?*

You'll also ask yourself how you can make games that will attract entirely new audiences, ones you haven't even touched. You will try to treat old themes in new ways,

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to anticipate the market, to hit the shelves just as interest peaks and technologies advance, and especially to align the players to your brand, getting them to demand upgrades and new products to buy. In short, to have them clamoring for more.

What if the goal of e-learning vendors, institutions and publishers, were to get the learners to "clamor for more?" Wouldn't that be different?

How realistic is this?

The vision just described is more realistic and closer than most would imagine. For in only a few years *all* individual on-line education "units" – courses or otherwise – will be able to include standardized, built-in assessments. Courses can then be "accredited" individually and accumulated by students from multiple sources. Business already uses a similar structure – although as yet without the built-in assessments – for accumulating "CPE" (Continuing Professional Education) credits.

As soon as individual course accreditation happens, the marketplace will take over. And academic institutions, I predict, will start having a really hard time.

A student will no longer have to enroll in *any* institution to major in, say, chemistry. He or she will merely go to the standardized curriculum online, and choose his or her e-courses, e.g. Introductory Organic, from among the highest-rated ones in the world, *regardless* of institution, just like a gamer selects his or her games regardless of publisher. Some central institution will certainly arise to accumulate and track his credits and issue a degree when he has enough.   Sure, the academic world – which today accredits institutions, not courses – will resist, raising great cries about "brands," "learning communities" and "standards." But that Berlin Wall, too, will eventually come down. And as the barrier crumbles, professors, publishers, and institutions will rush in to compete individually – as they have always done with textbooks, and are already doing with online courses – to create the learning experiences rated "five stars" by the reviewers.

In most academic subjects "content" below the most advanced level is relatively standard, and therefore fungible. And so as future students pore over reviews on Web sites and in magazines, voting course-by-course with their dollars*, it will be the courses' Gameplay and its accompanying motivation – not the content – that will be the deciding purchase criterion.* As a not-so-distant future student will put it, "Show me the fun."

In the jargon of today's students, "Gameplay Rules!"

Why? Because *Gameplay Motivates!*

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Notes

1. Donald A. Norman, *Things that Make Us Smart: Defending Human Attributes in the Age of the Machine. New York: Addison-Wesley, 1993, p. 38.*

2. The game, *Bottom Gun*, was designed by the Naval Air Warfare Training Systems Division. It is described in Prensky, *Digital Game-Based Learning*, McGraw-Hill 2001, pp 306-308. Results are preliminary findings from an internal, unpublished evaluation.

3. Johan Huizinga, *Homo Ludens, A Study of the Play Element in Culture*, Beacon Press, 1950, p.3.

4. Oxford English Dictionary, Second Edition, Oxford University Press, 1989.

5. Microsoft Encarta World English Dictionary, North American Edition, 2000, online at www.dictionary.msn.com .

6. Nicholas Negroponte, *Being Digital*, Vintage Books, 1996, p. 196.

7. Colin Rose and Malcolm J. Nicholl, *Accelerated Learning for the 21st Century*, 1998, p. 30.

8. Christian Bisson and John Luckner, "Fun in Learning: The Pedagogical Role of Fun in Adventure Education," *Journal of Experimental Education*, Vol. 9, No. 2, 1996, pp 109-110.

9. Cited in Bisson and Luckner. *ibid.* "Research and reflections of the concepts of fun/enjoyment have induced authors [cited in text] to directly relate intrinsic motivation and fun."

10. This quote by Marshall McLuhan exists on the Web in several variants. Although I was not able to track down a printed source, the quote was confirmed verbally by McLuhan's son Eric.

11. David Gelernter, quoted in *Online Learning* magazine, January 2001.

12. Clifford Stoll, *High Tech Heretic: Why Computers Don't Belong in the Classroom and Other Reflections by a Computer Contrarian*, Doubleday, 1999, p.12.

13. Dr. Sivasailam Thiagarajan, in a personal interview with the author.

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14. Ellen J. Langer, *The Power of Mindful Learning*, Perseus Books, 1997, pp. 29, 79.