using the technology of today, in the classroom today

The Instructional Power of

digital games social networking simulations

and How Teachers Can Leverage Them

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an Education Arcade paper

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Introduction

What is *good learning*? That may be a subjective question. But it's likely that many educators would give answers that fall in the same ballpark…

…students collaborating and discussing ideas, possible solutions…

…project-based learning, designed around real world contexts…

…connecting with other students around the world, on topics of study…

…immersing students in a learning experience that allows them to grapple with a problem, gaining higher-order thinking skills from pursuing the solution…

To many educators, these notions are music to their ears. Would it seem terribly strange then to hear that students indeed are doing these things regularly outside of their classrooms? While Timmy or Susie may not be running home from school saying, "What fun, deeply-engaging learning experience can we do today?", they are engaging with new technologies that provide them with the same opportunities. Every day, many students are spending countless hours immersed in popular technologies—such as Facebook or MySpace, World of Warcraft, or Sim City—which at first glance may seem like a waste of time, and brain cells. But these genres of technologies—Social Networking, Digital Gaming, and Simulations—deserve a second, deeper, look at what's actually going on.

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When you hear "MySpace" or "World of Warcraft," what do they bring to mind for you? What emotions do you associate with them? Have you heard of them before? Your students have, and they almost certainly have strong opinions about them. You don't need to be a teenager to use or understand these technologies, or to use them in your classroom. Market research data indicates that many a normal, middle-aged adult[1] uses these technologies with frequency. The fact is, you can be 17, 35, or 60, and when you begin to engage with them and observe what's *really* going on, you can begin to see that these technologies are more than just entertainment. These technologies are already demonstrating how they impact the way we think, learn, and interact—and they are also demonstrating the tremendous potential they have in these areas as well. The emergence of social networking technologies and the evolution of digital games have helped shape the new ways in which people are communicating, collaborating, operating, and forming social constructs. In fact, recent research is showing us that these technologies are shaping the way we think, work, and live. This is especially true of our youngest generations—those arriving at classrooms doors, soon to be leaving them and entering the workforce and society-at-large.

Our newest generation – currently in K-12 – is demonstrating for us the impact of having developed under the digital wave. These youth have been completely normalized by digital technologies—it is a fully integrated aspect of their lives (Green & Hannon, 2007). Many students in this group are using new media and technologies to *cre-*

1 According to the Entertainment Software Association in 2008, the average game player is 35 years of age.
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ate new things in new ways, *learn* new things in new ways, and *communicate* in new ways with new people—behaviors that have become hardwired in their ways of thinking and operating in the world. Green and Hannon give an excellent example of this, "Children are establishing a relationship to knowledge gathering which is alien to their parents and teachers" (2007, p. 38).

Not surprisingly, this "transformation" has serious implications for us in the space of education. Nearly all institutions – business, industry, medicine, science and government – have harnessed aspects of these technologies for decades. Games and simulations have been a key component of training doctors and military personnel, but even businesses like PricewaterhouseCoopers used a game about a mining company in outer space to teach its employees about derivatives[i]. Although that may seem a bit "off the wall," the fact is major corporations, the Department of Defense, and the medical community would not use these tools if they were not highly effective.

Although these examples are mainly centered on training purposes, there are deeper educational benefits to digital simulations and games. Yet educational institutions have been reluctant to embrace these technologies. Likewise, where schools have often shied away from giving students an online identity in a digital networking platforms to increase opportunities for learning, professional organizations are leveraging networking technologies to increase collaboration, knowledge-sharing, and production amongst their employees. Traditionally, education has been impeded by the security and other potential dangers of employing social networking technologies. These concerns should not be ignored; however neither should these tools due to these concerns. Advances in these technologies continue to afford us new ways to manage the potential dangers.

Simulations, digital gaming, and social networking technologies have all definitely suffered the same public relations problems that all new technologies do. However, there are countless examples of these technologies demonstrating their educational value to other industries, confirming the powerful learning opportunities and advantages they afford. It is our position that these technologies are safe, valuable tools schools must take seriously.

Of course, changing instructional approaches is no easy task, particularly when technology is involved. Adopting and integrating technology-based instructional strategies has a long history of challenges, but with it has come a great understanding of how to achieve success with them. In the contents to follow, we will discuss:

- the background and affordances of Simulations, Digital Games, and Social Networking;
- the cognitive implications of these technologies;
- specific challenges with using these tools in the classroom, as well as strategies for overcoming these challenges in order to achieve successful learning experiences; and
- the future of these technologies and their impact and learning and teaching.

Evolution, Not Revolution

Technology can have a reciprocal relationship with teaching. The emergence of new technologies pushes educators to understanding and leveraging these technologies for classroom use; at the same time, the on-the-ground implementation of these technologies in the classroom can (and does) directly impact how these technologies continue to take shape.

While many new technologies have emerged throughout history, so has the cry for educators to find meaningful ways to incorporate these technologies into the classroom – be it the typewriter, the television, the calculator, or the computer. And while some professional educators may have become numb to this unwavering 'call' – and for good reason – it is crucial to consider that the excitement over games and social networking isn't just business and industry "crying wolf." Indeed, those previous technologies have a powerful place in instruction and the classroom; but without them, strong lessons and learning objectives can still be achieved. With these more recent technologies, we think educators should take the call, even if only on a trial basis.

Undoubtedly, without these recent technologies (i.e. digital games, Web 2.0, etc.) in the classroom, strong lessons can still be achieved, but there's a sharp disconnect between the way students are taught in school and the way the outside world approaches socialization, meaning-making, and accomplishment. It is critical that education not only seek to mitigate this disconnect in order to make these two "worlds" more seamless, but of course also to leverage the power of these emerging technologies for instructional gain.

Of course, as a result of these assaults on formal education, those in the "outside world" are often quick to pounce on educators and the way education is (perceived to be) conducted in U.S. classrooms. This bandwagon perspective has become a mounting dialogue, charging the field of education with the imperative for a *revolution*—radical transformation of its system and practices. While it is clear that education is no different from the other sectors in its need to adapt and modify to our transforming world, it is also clear that many educators currently already implement excellent teaching practices and are able to skillfully create dynamic learning environments.

Attacking educators' current practices combined with the lack of acknowledgment of current best practices only hinders the growth of the education sector. There are countless educators who are masters at their craft, currently employing an array of exceptional instructional strategies. Lauding and building upon these strategies is critical to effective growth in the education sector in order to bridge the aforementioned divide. We advocate for an *evolution* in educational practices and approaches to instruction, which not only align with the processes and operations of the world outside of school, but also leverage the emerging power and potential of these new processes and technologies. Attending to this end of the technology-teaching relationship has the additional benefit of helping to shape emerging technologies that is most effective for cognition and instruction.

New Technologies...New Learning

Why digital gaming, simulations, and social networking? Simply put, these technologies afford us the ability to convey concepts in new ways that would otherwise not be possible, efficient, or effective, with other instructional methods. In other words, these technologies don't just help us teach the old stuff in new ways – they can also help us teach *new* stuff in new ways. Below we provide a brief description of these technologies; popular educational and non-educational examples of each, and what researchers and practitioners are finding about their potential and impact on teaching and learning.

Digital Gaming

Digital games encompass much more than your computer's Solitaire or Nintendo's Super Mario Bros. Over the last decade, the genre of digital games has exploded to include numerous platforms and designs. Digital games, whether computer-, game console-, or handheld-based, are characterized by rules, goals & objectives, outcomes & feedback, conflict/ competition/challenge/opposition, interaction, and representation of story (Prenksy, 2001) or more simply, "Purposeful, goal-oriented, rule-based activity that the players perceive as fun" (Klopfer, 2008). They are distinguished by two key elements: (1) an interactive virtual playing environment, and (2) the struggle of the player against some kind of opposition.

Gaming is already a widespread activity in our culture —more than 45 million homes have video-game consoles (Feller, 2006). Over 154 million Americans play video games (that's about half of the country's population) (Emrich, 2005). In a given week, the average eighth-grade boy will play video games for about 23 hours, while the average girl will play about 12—that's even more time than they spend watching TV (Dawley, 2006). Therefore, one of the most obvious benefits to using these technologies for learning is that students are often already familiar with these interfaces and the "language" of interacting with and utilizing them.

Both inside and outside the classroom, some strong examples of powerfully engaging gaming models have emerged. Some have been used quite a bit in the educational setting, while others have mainly garnered popularity in pop culture. We outline some examples of both below.

CIVILIZATION

This commercial, off-the-shelf (COTS) game originally appeared in 1991. As a result of the game's popularity design, multiple installations in the series have been developed. The goal of the game is to successfully build an enduring empire. The latest version, CIVILIZATION IV, allows players to form teams in order to increase collaboration and strategy efforts. In this turn-based strategy game, players must make decisions for their civilization around societal development and diplomacy—including when and where to build new cities, what societal advances in knowledge should be sought (and when), and how to handle adversarial and non-adversarial neighboring civilizations. At the onset of the game, players even have the choice of which civilization to play—Aztecs, Romans, Mongols, etc. As time advances in the game, new technologies emerge (such as pottery and nuclear fission) and civilization leaders have the choice to try to capitalize on these technologies or not.

The cultural popularity of CIVILIZATION has been tremendous, however it's also been highly touted by those in the educational space. Kurt Squire and folks at the Games, Learning and Society group have extensively written about, created materials for, and implemented CIVILIZATION in educational settings. They contend that playing a game like CIVILIZATION can be a profoundly powerful way for learning about history, and that through game-play players can gained advanced terminology and knowledge of geography, principles of history, and generally increase their interest in this area of study. Their website supporting this work [http://civworld.gameslearningsociety.org] has numerous resources for the educational implementation of CIVILIZATION—many of which have been contributed by students who have taken an interest in the game.

Civilization

type: commercial

game complexity: moderate

overview: players select a historical civilzation to develop in a sustainable way

goal: to be the dominant, surviving civilization

Games like CIVILIZATION have an easier onramp to the educational space than other COTS games that are a big hit in popular culture that at first glance may give off the guise that they would have zero educational value. However many of these types of games have also been able to demonstrate their tremendous ability to cultivate key skills, which although may not be directly related to a content area, they are critical higher order thinking skills applicable in all areas of life. Perhaps the most prominent example of this is the online, multiplayer game **WORLD OF WARCRAFT (WOW)**.

While not targeted at education, nor seeking to cover any type of educational content, Green & Hannon (2007) cite multiple skills associated with being a "guildmaster" (one of the roles in WOW):

- attracting, evaluating, and recruiting new members;
- creating apprenticeship programs;
- orchestrating group strategy; and
- managing disputes.

World of Warcraft (WoW)

type: commercial (MMORPG)

game complexity: variable

overview: a fantasy role-playing game, like Dungeons and Dragons, played over the Internet with millions around the world

goal: outfit and improve your character through quests both cooperatively and competitively with other players.

As you might imagine, these are frequently cited as being skills highly sought after in the workplace. Both of these games – CIVILIZATION and WORLD OF WARCRAFT – provide us with clear demonstrations of the educational implications and possibilities of COTS—and as educators continue to adopt and adapt these games, we will in turn further learn the benefits and best designs of these games.

LURE OF THE LABYRINTH

Designed to appeal to youth like a COTS game, the LURE OF THE LABYRINTH was most certainly created with educational intentions. Designed at the MIT Education Arcade in development collaboration with Maryland Public Television, Fablevision, Johns Hopkins University, and Macro International, LABYRINTH is funded by the U.S. Department of Education with a primary goal of enhancing pre-algebra mathematics learning, and a secondary goal of improving literacy. LABYRINTH is a web-based, long-form puzzle adventure game played over many sessions. The game's storyline is a persistent narrative that evolves over time, where the player's character enters the game looking to recover a lost pet and subsequently is led by clues through a fantasy world—an underground factory populated by mythical monsters who are stealing pets. By the game's conclusion, players will have recovered their own pets, freed many others, and halted the monsters' plans by destroying their factory…using algebra. As a result of the player exploring this space, learning how to navigate it, and solving puzzles with mathematical reasoning, players can earn enough points to free their pet.

These puzzles are the central mechanic of the game. Often, players will not succeed on a puzzle on the first try, and the second time the puzzle is encountered the piece will be different (although the dynamic, or puzzle rule, will still be the same). Throughout the game, players are in communication with teammates via an in-game message board. Players seek or give advice about solving individual puzzles or the overarching game goals. However, since no puzzle is ever the same twice, help for teammates can only offer meta-level thinking about the game. This skill of articulating the solution, makes them valuable team members, and also builds skills required on many standardized assessments. Ultimately, these puzzles were designed to help students embody the thinking, processes, and habits of mind of a scientist, mathematician, or engineer—which include:

- probing (sometimes random, sometimes focused),
- observing one's environment in response to stimuli introduced,
- forming hypotheses, and
- testing and altering single variables.

For more Educational Games, go to www.educationarcade.org

While additional high quality research on the effects of gaming is needed, there are important reasons for educators to engage with digital games. Initial reports show that gamers have well-developed skills including enhanced visual perception. Researchers such as Patricia Marks Greenfield also argue that habitual playing of video games results in the development of new cognitive abilities that translate into the key skills for our transformed world (Facer, 2003):

- The ability to ***process information*** very quickly;
- The ability to determine what is and is not of relevance to them;
- The ability to ***process information in parallel,*** at the same time and from a range of different sources;
- Familiarity with exploring information in a non-linear fashion;
- A tendency to ***access information*** in the first instance ***through imagery*** and then use text to clarify, expand, and explore;
- Familiarity with non-geographically bounded ***networks of communication***; *and*
- A relaxed approach to '***play***,'—the capacity to experiment with one's surroundings as a form of problem-solving (Jenkins, Purushotma, Clinton, Weigel & Robison, 2006).

Other researchers have found that games improve skills in communication and collaboration, problem-solving, and various number-related skills (McFarlane, Sparrowhawk, & Heald, 2002). Gee (in press) expands the skill set potentially (as it can vary from game to game) developed by games to include:

- pattern and rule recognition;
- '***embodied empathy' for a complex system*** ["where a person seeks to participate in and within a system, all the while seeing and thinking of it as a system and not just local random events" p. 5-6];
- ***fluency with 'cross-functional affiliation'*** [operating in a group to achieve a goal, by using specialist and general common knowledge necessary for group operation(s)]; *and*
- illumination of attributes of human cognition, distributed intelligence, and situated meaning.

Diplomacy

type: commercial

game complexity: lower

overview: simulates the political and military conditions of Europe in the late 1800s/early 1900s

goal: take over Europe

What all these skills represent are the ways in which individuals are increasingly required to effectively operate and function in our highly digital world. Any educator can tell you ample anecdotes of where a critical piece to a classroom project was accessing, sorting, and processing information, exploring possibilities to identify problem solutions, and collaborating with others (both live and asynchronously) in order to achieve a goal. Although the aforementioned capacities don't show up in all state standards just yet, national organizations such as AASA have already identified and supported these skills as critical capacities for 21st century operation.

Meet Ross…7th Grade Central Subject Teacher

At a traditional independent school in Cambridge, Massachusetts, the curriculum is anything but digital. Although technology is valued, this pre-K – 8 school is built upon the philosophy of "education through meaningful real-world play and exploration." It may seem strange then that Ross has embraced and been wildly successful with digital game-based education in his classroom. For the past several years, Ross has been using commercial, content-related games like DIPLOMACY in his classroom. Although he believes the ideal scenario is to partner up students on one computer and each team plays the role of a country, he has also played the game as a whole class at the front of the room via one computer and a projector, which serves as the content from which Ross facilitates the activity. For Ross, there are numerous benefits to playing DIPLOMACY in the classroom versus his traditional instructional methods—one of the strongest benefits of the game is the framing of the content as the students explore and interact with the scenario-at-hand (such as the political causes of WWI as found in DIPLOMACY). This serves a profoundly engaging vehicle for covering the content in his curriculum. However, Ross has observed in his classes that DIPLOMACY provides additional benefits that would otherwise be challenging for him to emulate:

- teaches students about the skill of negotiation,
- teaches students how to solve problems collaboratively, and
- teaches students to be mindful of their actions/impact on others (an attribute of *Systems Thinking*).

Ross sees these habits of mind, or conceptual knowledge, as the greatest outcome of the learning experience. "The conceptual knowledge is critical because if you can grasp that, then you can transfer skills and morph into other domains, roles, and work more easily. With digital games, students get to experience the concepts versus passively watching a video on it."

The learning benefits described by Ross seem clearly advantageous. But is there an inherent benefit for Ross? According to him, having tools like digital games has only enhanced his teaching. "Games don't teach the content…it teaches [students] the conceptual knowledge and sets the environment for you to teach what you want."

Simulations

Although analogous to digital games and often included in the gaming spectrum, simulations are "analog[ies] of a real world situation[s]" (Prensky, 2001, p. 128), as they recreate a modeled or modified version of a real world situation. One essential aspect that separates digital games from simulations is the lack of game dynamics or the "win state" that exists in digital games. Some examples of simulations include:

Molecular Workbench

As technology has improved, so has the quality of simulations developed for education. Developed by the Concord Consortium in Concord, Massachusetts, Molecular Workbench provides interactive, visual simulations to aide in teaching simple and complex science concepts, such as dynamic molecular structures (Tinker & Xie, 2008). Molecular Workbench also has a unique additional instrument—a reporting and assessment system—which can be used by teachers to can collect data and measure learning with models and simulations.

StarLogo: The Next Generation (StarLogo TNG)

Simulations do a great job of helping learners to visualize and conceptualize complex phenomena. However, the learning can be even more powerful when the student is creating and altering a simulation they themselves are building. StarLogo TNG is an open-ended tool that allows the user to do just that. A 3D modeling and simulation software, StarLogo TNG is a user-friendly programming language represented by colored blocks that fit together like puzzle pieces. The programming possibilities are seemingly endless, and numerous teachers in math and science have created an array of applications with it—including a model of a health epidemic to a simulation of the dynamics between fish and plankton (Klopfer, Scheintaub, Huang, & Wendel, 2009; Klopfer & Scheintaub, 2008a & 2008b).

SimCity

One of the first, and biggest, COTS simulation games to come onto the market was SimCity—where the objective is to design and create a thriving, sustainable city. Players designate which land is residential, industrial, or commercial, and as the mayor of their city they are forced to confront issues of pollution, crime, waste management, transportation, and so on. By building their own city, they are in control of the various parts that make up a city system, helping to underscore concepts of system dynamics. The scenario that this presents allows for direct connections to economics, math and science. SimCity also comes with built in scenarios—real world cities with the occurrence of a fictional event (although a few scenarios are based on actual events in history)—such as "Boston 2010" where there is a nuclear meltdown in the city and the mayor must contain toxic areas and rebuild, and "Hamburg, Germany, 1944" where bombing from WWII has destroyed much of the city and the mayor must guide the city through the end of the war. These scenarios serve as excellent jumping-off points for your instructional endeavors and curricular needs.

For simulations to be successful at whatever their goal, they need structural elements to give them shape, and this often comes from the rules of game-play and/or digital enhancement (Prensky, 2001). Many of the same benefits and skills previously detailed around digital games are also true for simulations. For simulations to be effective instructionally in the classroom, they, like most instructional tools, need guided facilitation from the teacher. However, the beauty of simulations is that they create learning opportunities and experiences that might otherwise never be able to be created in the traditional classroom—learning experiences that are authentic models of real world situations, allowing for strong transfer of understanding to real world situations.

Truly, creating authentic learning experiences is perhaps the most critical aspect and benefit to digital games and simulations—bridging the all-too-well-known gap between the classroom and the real world. The learning has meaning and relates to the real world because it is modeled on the systems of the real world—not broken down, compartmentalized, and stripped from context as many lessons must be in order to be compacted into a 45-minute period. The majesty of well-designed learning games and simulations is that through technology they present a scaffolded, simulated world in a manner that makes it more digestible and engaging for students. Shaffer explains, "computers...let us work with simulations of the world around us... and these simulations let us play with reality by creating imaginary worlds where we can do things that we otherwise couldn't do at all" (2006, p. 9). Not only is this highly motivating and engaging for students, it allows students to retain, connect and transfer learning from these experiences to future learning and experiences.

Meet Hal & Kali…12th Grade Physics Teachers

Simulations in physics class? That doesn't seem out of place. But in the classrooms of Hal and Kali in Lawrence, Massachusetts, simulations are much more than a digital depiction of "trajectory" or Newton's laws of motion. For the past eight years, veteran educator Hal has been using StarLogo TNG (described above) to create digital simulations to demonstrate the principles of complex concepts such as evolution or the factors in a forest fire—two concepts that would otherwise be difficult for the students to experience.

Helping students gain conceptual understanding of these challenging concepts is just one major outcome of tools like StarLogo TNG—but since it also allows users to create and program their own simulations, students can be creative problem-solvers, and demonstrate mastery of the concepts by altering the simulation based upon their understanding of how it works. For Hal, this coupling the simulation with programming in his class is the most powerful manifestation of experiential learning.

"I will give students a partial simulation of a forest fire. The kids then manipulate the simulation to program a solution—such as programming a fire fighter. Kids can then compare these multiple solutions." According to Hal, "it's different from the science test I just gave," because it allows him to pose more interesting questions and to allow students to generate multiple correct answers instead of looking for one "correct" answer.

A few years ago, a new colleague named Kali joined the school's science department. Although Kali was just getting her feet wet as a classroom teacher, the two found that collaborating around a tool like StarLogo TNG created great synergy that elevated both of their instructional practices. Although each uses the tool differently in their respective classrooms, the discussion and collaboration of using this tool has leveraged new ideas and illuminated critical contributions that each agrees they probably would not have come to on their own. According to Hal, "the best part is it's provided a way to collaborate with a colleague across disciplines, gender, and age differences, in the same collaborative ways we seek for our students to develop while using StarLogo."

Social Networking

Social networking could be seen as a technology with fewer evangelists for its use as an instructional tool, but it shouldn't be, given the number of subscribers to this technology. Beating out Google in terms of traffic, the social networking site MySpace logged almost 46 million users in June 2006 (Albanese, 2006). Just to emphasize, that was just the site MySpace *alone*. These sites allow the user to do it all: post a profile, photos, videos, chat, blog, and connect with their peers through individual bulletin boards, private groups and forums.

These numbers reflect all users, from all demographics and age ranges. It is highly likely that the 'tween' and teen group (nine- to 17-year-olds) are the heaviest users of this technology. A recent report published by the National School Board Association (2007) found that 96 percent of youth in this age range have used social networking tools at some time, with their average engagement with them rivaling time spent watching TV at 9 hours a week. Yet perhaps the most stunning statistic of their study is that the topic of most conversation at these sites is *education*—60 percent of the students' surveys said they use the sites to talk about education topics and more than 50 percent use it to talk about specific schoolwork.

What are the critical aspects that define a social networking technology? Traditionally, traits of these tools include creating a login on the site, which provides you with a profile page where you often can add pictures and other content. You can then connect with other people you know, or may have met through this site, by becoming their "friend"—a designation to the site that you two are connected in some way. This affords you the ability to receive updates on your "friends' " pages, communicate with them via in-site email/comments/chat, and create specific groups on the site around themes or content.

Culturally popular sites like MySpace, Facebook, and Bebo however, have received intense backlash from schools which are fearful for the online safety of students using these sites, as well as the concern that students will misuse them during what is supposed to be instructional time. As a result, numerous alternative sites have emerged to provide teachers with more suitable platforms to host classroom online communities.

Ning

Although not specifically created for classroom use, Ning's personalization and privacy settings have been quite successful in education. Teachers can create their own private social network housed within the Ning site. In this way, the teacher can designate who is and is not able to participate in their social network. As the network's administrator, the teacher may also enable to disable specific parameters, such as chat and messaging, if so desired. There are many great examples of schools and classrooms already successfully implementing these sites in the classroom. This type of site has been shown to be excellent for facilitating group projects using those tools[2].

THINK.COM

This learning platform is more than just a fancy social web space. Hosted by the Oracle Education Foundation, this free service is designed to be a password-protected, teacher-monitored, safe web-space that is free from advertising. The site is filled with project ideas and tools to help users create those projects, in an online space where students and teachers can collaborate together. This high-quality site maintains its quality standards by requiring an application by the school in order to receive an account, and careful monitoring of student activity appropriateness.

DIIGO

This hybrid social networking – social bookmarking site does an excellent job of incorporating many of the components of traditional social bookmarking sites, such as a developed user profile, grouping based on background/interests, and so on. But what makes Diigo special is it's the embedded tools that let you treat the Internet like your own personal notebook that can be accessed by anyone you choose to have access to it. With a simple download, users can highlight parts of webpages, attach sticky notes to a webpage, and then share these annotations with others.

PANWAPA

Don't think that social collaboration sites are limited to the older kids. Sites like WEBKINZ and CLUB PENGUIN are gaining momentum in the pre-teen age group. Although student interest in these sites has made many educators stop and take notice, they have left many skeptical and unclear of how to proceed with them as an instructional tool. Seeing the potential in these technologies, the folks at Sesame Workshop – the same leaders in the field of primary education who produce Sesame Street – have created PANWAPA—an interactive site where users explore the world and its various cultures through creatures and characters that Sesame Workshop is known for. Complete with a Teacher's Guide, printable activities, and online communities, PANWAPA leverages the abilities of social networking while being designed from the start as a robust educational tool.

Since a key characteristic of social networking sites is for each user to have their own profile, they have the ability to create their online identity and connect with anyone from around the globe also profiled on the site. In the age of globalization, this is a tremendous opportunity to connect students with other students who have similar interests as well as different experiences.

This gets at the heart of social networking technologies—*social cognition*. These emerging technologies have connected people in so many ways—ways that not too long ago would have been unimaginable. As a result, we have seen an explosion in the processes and capacities individuals, as they collaborate and leverage others' abilities in new ways. These new ways of operating in the [digital] world illuminates new capacities and skills central to

[2] See "The Promise of Social Networks" by D. Baird in *TechLearning*; November 1, 2005.

this modus operandi[3]. Jenkins et al. note that these new capacities "almost all involve social skills developed through collaboration and networking. These skills build on the foundation of traditional literacy, research skills, technical skills, and critical analysis skills taught in the classroom" (2006, p. 19). These are all critical skills, often developed in conjunction with *distributed* learning environments—designed to leverage activities around principles of *distributed cognition,* and *collective intelligence*. These two skills in particular are based on the view that intelligence is more than just an attribute of an individual, but distributed amongst brain, body, and world (Clark, 1997); improved reasoning is made possible by the use of technology to "expand and augment human's cognitive capacities" (Jenkins et al. 2006, p. 37). Furthermore, "knowledge cultures" assembled in these online communities produce the capacity for cognition and accomplishment far beyond what one person alone could accomplish.

Meet John…Literature teacher at a small, rural high school

What could social media possibly do for John's classroom? He wasn't sure, but he gave it a shot to see what he could find. Last year, John jumped right in by starting a blog. At the time, he wasn't really sure what he'd use it for, or exactly who the audience was, but he figured it was worth trying out and seeing what it was about. It wasn't long before John saw how blogs could be very engaging, for both him and those who followed his writings.

John's success with blogs led him to create social networks for each of his classes using Ning. From the start, these networks were well received by the kids and lively with activity. John used the networks as a way to communicate assignments, class discussion, and content that supported their work—such as videos related to his class' literature study of *Fahrenheit 451*. John's favorite outcomes from these tools are the opportunities for real world application of the ideas being covered. Through the site, students were able to continue discussion outside the classroom via the discussion board, and sharing their ideas and work online, which allowed for more opportunities to see other students' work and learning. These tools "open up whole new lessons that feel very applicable for their future." In fact, John's social networks were so popular that many of his students would check into them to see if anything what was happening, even though John hadn't specifically posted an assignment or activity.

John found other interesting effects as well. This online social network was an incredible vehicle for one of his students with social anxiety disorder who would frequently have to go home early because of the disorder. Not long after John launched the network, this student was avidly posting comments and facilitating discussions amongst students within the site. "She ended up becoming extremely involved in the online network, becoming one of the most active students on it," which opened up new ways for her to communicate and socialize with students. Although John's students were by-and-large fairly tech-savvy, there still were of course students who had little or no access to technology at home. By the end of the school year, John had discovered one of these students had created his own network around one of his own passions—trading guitar tips. One year into this endeavor, John is convinced of the powerful educational abilities of such technologies. "It was me giving the kids something 'cool', the kids saw that and respected it…and it elicits from the kids the respect it deserves. It didn't need to be demanded."

[3] For a deeper look at many of the capacities, see the Project NML white paper, *Confronting the Challenges of Participatory Culture: Media Education for the 21st Century* by H. Jenkins, R. Purushotma, K. Clinton, M. Weigel & A. Robison.

The Other Side of the Evolution

Throughout the past few decades, the emergence of new technologies has been paralleled by the evolution of theories on cognition and learning. Where learning and the mind were once viewed as "filling of the bucket," the "social mind" is now a much more prevalent model. Of course, educators have long been aware that learning is a social activity, where learners construct their understanding not just through interaction with the material, but also through collaboratively constructing new knowledge with their peers. This collaborative learning process, where children's cognitive development is supported through the interaction and coordination of different perspectives amongst peers (Bearison & Dorval, 2002), plays out in pedagogical terms as Social Constructivism. Familiar aspects of Social Constructivism include *situated learning*, where students engage in activities directly relevant and applicable to the concepts and context in which the learning will be applied (Brown, Collins, & Duguid, 1989), and *cognitive apprenticeship*, where students learn through carefully scaffolded projects where expert behavior is modeled and mediated through peer interaction. Why are strategies like these important? Because these pedagogies are the onramps to deep learning. Simple learning can be accessed through various methods, but acquiring complex skills requires "social interactions in situated contexts, which allows them to see how the various parts of the process fit together" (Trent, Artiles, & Englert, 1998, p. 285).

Ill-structured domains, such as history, are particularly well-suited for the Social Constructivist approach, where language and co-construction of concepts is central. The collaborative, communicative, interrelated nature of the Web makes it an especially ideal tool for supporting Social Constructivism in the classroom (McMahon, 1997). This may seem apparent with social networking technologies, but the powerful learning attributes of digital games and simulations are can also be enhanced when they occur online, in a networked fashion (as described in our discussion of WORLD OF WARCRAFT). With all of these technologies, they demonstrate their ability to be excellent tools for supporting social constructivism in the classroom—not only through the real time interaction amongst classmates around the technology, but those synchronous and asynchronous interactions that occur virtually with classmates and other peer learners.

Learning Theory = Teaching Practice

Our innate beliefs about things like how we think people learn are often unstated, but serve as the "operating system" upon which we base our instructional decisions in the classroom. These technologies align strongly with the constructivist and social constructivist theories of learning, and therefore will also fit well into classrooms where these theories of learning are embraced. As new technologies push instruction in the classroom in new ways, so to does our ability as professional educators push the evolution of educational technologies. With the recent tide of Web 2.0 technologies (web services which center around user-provided content, like flickr, YouTube, or Facebook), one can only speculate where things go from here.

Moving Forward

"What aren't these technologies used more in education?"

If you are – or have ever been – a classroom teacher, you probably already understand much of the answer to that question. As Ed Tech pioneers have begun test-bedding these technologies in the classroom, we've learned a lot about the issues educators are likely to face in implementing these innovations.

Overcoming Barriers to Innovation

Groff and Mouza (2008) discuss six central factors, each with its own critical variables, that interact with one another to produce barriers to implementing technological innovations in the classroom: (a) *Research & Policy* factors, (b) *District/School* factors, (c) factors associated with the *Teacher*, (d) factors associated with the *Technology-Enhanced Project*, (e) factors associated with the *Students*, and (f) factors inherent to *Technology* itself.

While all dimensions are undoubtedly important, not all of them have the ability to be manipulated or accounted for by individual teachers. Research & Policy factors exist outside the district or school boundaries and, therefore, cannot be easily manipulated by individual teachers. The same is true for factors inherent to Technology itself. Although the characteristics of various types of technologies can facilitate or hinder efforts to use technology, teachers cannot (in many cases) directly influence or alter those characteristics. For these reasons, Groff et al. have focused on the remaining four factors, those capable of being influenced by the teacher's actions, upon which they have developed the $\mathbf{i^5}$ Framework—a tool to help educators successfully integrate new technologies into their teaching practices. By reviewing the $\mathbf{i^5}$ prior to initiating a specific technology-based project in mind, educators have the opportunity to identify and address concerns so that they might achieve greater success (see Appendix). Each of these four factor areas are discussed below:

THE CONTEXT (*School*): school and district culture

- What is your *Organizational Culture* like? Do your colleagues, peers, and administrators discuss or collaborate with you on projects and lessons? Do they support this type of instruction?
- What kind of *Human Infrastructure* does your school have? Are there technical and pedagogical support people in your building or district to support you in this endeavor? Is your administrator able to support your project by acquiring unforeseen components?
- What kind of *Technology Infrastructure* does your school have? Does the technology within the school itself exist to support your project (i.e. access to computers, high-speed Internet, access to other necessary peripherals)?

THE INNOVATOR (*Teacher*): your beliefs, methods, experiences, etc.

- How *Technologically Proficient* are you? Are you familiar with the technologies in this project?
- What are your beliefs about a *Tech-Integrated Pedagogy*? Researchers have established a good pedagogical mindset that often accompanies good technology-based instruction, where the learning is constructivist and student-centered...how close is your teaching style to this?

- What is your *Knowledge of Resources*? Do you know what outside resources (other people, websites, books, etc.) that are available to guide you in your work? to contact if you get stuck?

THE INNOVATION (*Project or Tool*): the technology, as well as the project design for it

- How distant from the *School Culture* is the project or innovation? Does the tool support the curricular and pedagogical goals of the school?
- How distant from *School Resources* is the project or tool? Can the technology and other resources in your school support this tomorrow, or do you need upgrades/modifications/additions?
- How distant is the innovation from your *Current Practice*? Will using this instructional tool be similar to your current methods of teaching? Have you done something similar in the past to draw from?

THE OPERATOR (*Students*): how your students operate in the role of a student; what are their beliefs/attitudes; the actual role in the classroom with which they are comfortable

- How *Technologically Proficient* are your students? Are your students familiar with the hardware you will use? How fluent are they with the software, especially the social concepts and practical applications associated with it?
- How familiar with the *Project Style* are your students? Does the innovation use experiences and pedagogies your students have seen before? Will it place them in a role with which they are comfortable?
- What are the *Attitudes and Beliefs* of your students toward the innovation and its use for educational purposes? What is the general attitude of the class towards the innovation? Does this vary when the innovation is used in the classroom setting?

Rising Above the Barriers

Without a doubt, there will be challenges to implementing these technologies in the classroom. Even the most fundamental, non-tech lessons have their hiccups. And like anything that is new, there is a learning curve. But the challenges may not be as great as you think, and the easiest way to avoid the hiccups is to spend a little bit of time with these technologies before hitting the classroom floor, in order to address and potential obstacles.

As we've seen so far, Ross, Hal and Kali, and Lucy, have had great success with these technologies as learning tools in their classrooms. That's not to say it was easy sailing for them from the beginning. By going into these endeavors knowing there would be bumps in the road, these teachers continue to learn from the challenges and persevere—as a result, they have some great insights to share with us along the way.

Ross

Overall, Ross has had great success with DIPLOMACY in his classroom. Yet Ross quickly found that not all games are a good fit—sometimes for the content and concepts he is trying to cover, and sometimes for his particular students. "We used the game EUROPA UNIVERSALIS one year in my classroom, and it was far too complex. The kids just really struggled with it." An additional challenge with this game was that Ross could not get it to work reliably on the network, and it didn't run well on just one machine. Ross found greater success with the game COLONIZATION, and ultimately finding the right game is the same as finding any good instructional strategy—explore, try different things, adjust them where necessary, and so on. But most of all, he advises, particularly when it comes to the technology of digital games, "just be willing to tinker!"

Even though there was a high motivation/engagement factor for his students, there were still a few who "didn't really like games." Yet Ross found that "through the game they were able to get a deeper, more complex understanding of the concepts." For these students, Ross explained that he had to do a little more to keep them motivated, and often find additional materials for engaging them. In the end, all of Ross's students performed better on his own self-constructed assessments than classes prior to using COLONIZATION.

Hal & Kali

With 3 years under their belts collaborating together, Hal and Kali have a great synergy for levering simulations in their classrooms. But that's not to say that there weren't challenges along the way. Eight years ago when Hal started, technology proved to be a great challenge—not only innately, but in his students' lack of experience with these technologies. Having not grown up with these technologies, Hal indicates this was a large challenge for him. However, since then, the tools and technologies continue to get better and the students are generally more innately experienced with them today, resulting in fewer and fewer technical challenges and bumps in the road.

According to Hal, the greatest challenge that remains is bringing something into the classroom that is so open-ended and not teacher-directed. A teacher new to these technologies "could be afraid because they don't know what will happen." It can be unnerving when the teacher doesn't know the answer to a problem that presents itself. For Hal, this is the best situation for learning because "you and the kids become partners in learning." Hal has found that, "you don't always know what the kids want to do, and are going to do (if they are willing), but if they are, it's so fun and so worth it!"

John

Before last year, social media was very new to John, and to his entire school in general. "It was a steep learning curve for me…I'd prep something, introduce it, and [the students] would rip through it so fast because it is second-nature to them." But John's willingness to play with the technologies in his own life, and an open-mind to these uncharted waters left him with great success. As a result, others in his school have picked up on it as well; this summer the A.P. Calculus class began using social networking to support their summer work. "The more I do, the more supportive my school becomes."

Networking has helped build greater relationships amongst the students, and him as well. For those students without access at home, John provides them with more support and opportunities to interact with the technologies—something he has found results in a greater reciprocal respect between them.

Like all of these technologies, social networking isn't without its classroom management blips. Although John hasn't reported any very bad activity in his online communities, he did have an incident of a student posting a sarcastic remark about another student's work. Although the two were friends and the sarcastic comment was actually the student's way of praising the other's work, it nonetheless raised some classroom concerns and discussion. "We used the comment as a great teachable moment, which led to the set up of classroom standards for the community."

Strategies for Success

As educators continue to explore and expand these technologies, the educational community as a whole will grow its collective body of knowledge of best practices with them. Anecdotal stories like those of Ross, Hal and Kali, and John illuminate for us some common principles as a starting point for any educator.

Explore. Spend time just playing with these technologies. Head out to your local electronics store and try out a popular video game. Create a FACEBOOK account or try surfing NING to see how other schools are using it (they're free!). Many simulation tools, like Molecular Workbench and StarLogo TNG, are free downloads as well. Since so many of these technologies are delivered via the Internet, they are easily accessible—getting familiar with them is just an "open mind" and a click-away.

Partner with a colleague. Whether a long-time colleague and friend, or a new teacher on campus who teaches in a different department, great benefits can be had in all types of collaborations. Strike up a conversation at lunch about a particular technology that interests you and see what fellow colleagues chime in with. Find ways to try things together or share notes on things you've done independently—it's a great way to bounce ideas off of someone and learn from their successes and challenges. Can't find anyone at your school? Attend a session at a conference, or search the Internet for teachers who use them. Remember the class on NING you that you thought looked good? Contact the teacher managing that site to ask questions and get ideas. Building relationships with fellow educators around a new instructional tool is a great way to build a support network, and today's technologies make it easy to communicate with colleagues near and far.

Find additional supports. Express your interest to the Academic Technologist at your school. They'll likely be able to put you in touch with several resources to support your work, and help you get started. Many resources exist via the Web; for example, StarLogo TNG has a listserv where members are educators just like Hal who have questions, and insights, about using this tool in the classroom. Oftentimes you can get support from the tool designers themselves – feel free to ask!

The Now, and [not so distant] Future

Many agree that games, simulations, and social networking technologies have much to offer education. Yet while the benefits of these offerings are still making themselves apparent, a growing number of educators are making sure they are on the front-end of the wave. By appreciating that the students filling their classroom chairs have a different perspective on the world, these teachers are able to experiment with new ways to connect with kids through these technologies. Moreover, the research is supporting this work, showing that “multimedia education improves both comprehension of the lesson material and students’ interest in the lesson topic” (Brady, 2004).

Where is this work headed? And what does the future look like? While no one can say for sure, it is clear that the strong academic examples and applications of these technologies are growing exponentially. And others offer us a glimpse at where the front-runners of the field are headed.

At the Institute of Play—a non-profit led by professor and game designer Katie Salen—big plans are in the offing for creating a new type of school. This school is in its developmental phase, pushing on the very ideas of this paper. For the past several years, this research-based, youth-oriented organization designs game-based learning environments, curriculum, and professional development programs centered on helping teachers gain fluency in the effective use of digital media and games for learning. Building on their research and knowledge in this area, this school—entitled Quest to Learn—is a 6-12 public school for New York City set to open in 2009, and will use game design and game-inspired methods to teach critical 21st century skills and literacies as well as content in traditional subjects. Salen is looking at the future of learning, and believes that the creation and use of games can be a foundation for learning and innovation in our ever-accelerating world.

Seem extreme? As we begin to truly examine games and what they offer, we get a deeper sense about their educational power. As Salen explains,

> *"One of the powerful ideas undergirding games is the fact that games work as rule-based learning systems, creating worlds in which players actively participate, use strategic thinking to make choices, solve complex problems, seek content knowledge, receive constant feedback, and consider the point of view of others. As is the case with many of the games played by young people today, the school I am working on is designed to enable students to “take on” the identities and behaviors of explorers, mathematicians, historians, writers, and evolutionary biologists as they work through a dynamic, challenge-based curriculum with content-rich questing to learn at its core. It’s important to note that it is not a school where whose curriculum is made up of the play of commercial videogames, but rather a school that uses the underlying design principles of games to create highly immersive, game-like learning experiences. Games and other forms of digital media serve another useful purpose: they serve to exemplify the complexity and promise of “systems.” Understanding and accounting for this complexity is a fundamental literacy of the 21st century."*

Certainly, the work of Salen’s group seems like it is so far beyond the conventional that it must be the distant, if ever, future of mainstream practice. Yet at the same time, the world we are preparing our students for is so rapidly changing that we have little idea of the knowledge, skills, and experiences students will need in their young adult and adult lives. We need to be conceptualizing and experimenting with new methods in education, so that we are better able to adapt to the dynamics of our changing world. Games, simulations, and social networking are already permeating the workplace as productivity and development tools—we may be doing our students a large disservice by not integrating these tools into their education. At the same time, we must acknowledge that there is a reason these tools have been adopted so pervasively in the workforce—these groups are identifying the advantages of these tools and are leveraging them to enhance their work. If they are able to see many of the advantages of these tools in their productivity, what might educators find in student performance?

Where are we headed with the use digital games, simulations, and social networking technologies in educational practice? While we cannot say for certain, we can say that the capacity for digital games, simulations and social networking technologies to facilitate and leverage deep learning is evident enough to warrant further exploration and the development of new best practices. But we don't need to wait for the distant future to understand if and how we can implement these technologies. Students today are using these technologies *now*, and if you look around, it is highly likely that there is a Ross, a John, or even a tag-team like Hal and Kali right down the hall from you. And while, Ross, John, Hal, and Kali may not have all the answers, they are indeed finding strong results. Through every day explorations like these in the classroom, it is teachers who are building the steps towards the *future*.

References

Albanese, A. (2006). Google is not the net. *Library Journal*, 32-33.

Bearison, D., & Dorval, B. (2002). Constructive features of collaborative cognition. In, *Collaborative Cognition: Children Negotiating Ways of Knowing*. 117-121.

Brady, J. (2004). More than just fun and games? *Applied Clinical Trials* (November 2004). Retrieved July 16, 2007 at http://www.actmagazine.com/appliedclinicaltrials/article/articleDetail.jsp?id=131503

Brown, J. S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher, 18*(1), 32-41.

Clark, A. (1997). *Being There: Putting Brain, Body, and World Together Again*. Cambridge, MA: MIT Press.

Dawley, H. (2006). Time-wise, Internet is now TV's equal. *Media Life* (February 1, 2006). Accessed at http://www.medialifemagazine.com/cgi-bin/artman/exec/view.cgi?archive=170&num=2581 on August 7, 2007.

Facer, K. (2003). *Computer games and learning*. Futurelab.

Feller, B. (2006). "Scientists say video games can reshape education." *The Seattle Times*; October 18, 2006.

Gee, J. (unpublished manuscript). *Why are video games good for learning?* Academic Co-Lab. http://www.academiccolab.org/resources/documents/MacArthur.pdf

Green, H and Hannon, C, 2007, Their Space: Education for a digital generation, online version, accessed September 4 2007, http://www.demos.co.uk/files/Their%20space%20-%20web.pdf

Groff, J., & Haas, J. (2008). Groff, J., & Haas, J. (2008). Web 2.0: Today's technology, tomorrow's learning. *Learning & Leading with Technology*, September/October 2008.

Groff, J., & Mouza, C. (2008). A framework for addressing challenges to classroom technology use. *Association for the Advancement of Computing in Education (AACE) Journal, 16*(1), 21-46.

Jenkins, H., Purushotma, R., Clinton, K., Weigel, M., & Robison, A. (2006). *Confronting the challenges of participatory culture: Media education for the 21st century*. Chicago, IL: The MacArthur Foundation.

Klopfer, E. (2008). *Augmented learning: Research and design of mobile educational games.* Cambridge, MA: MIT Press.

Klopfer, E., Scheintaub, H., Huang, W., & Wendel, D. (2009). StarLogo TNG: Making agent based modeling accessible and appealing to novices. In Komosinski, M. (ed.) *Artificial Life Models in Software, 2nd edition*. Springer.

Klopfer, E., & Scheintaub, H. (2008a). *ICLS Proceedings, Utrecht 2009 StarLogo TNG – Making content-centered game and simulation development accessible to students and teachers.* {Conference paper}

Klopfer, E., & Scheintaub, H. (2008b). *AERA StarLogo TNG – Making content-centered game and simulation development accessible to students and teachers.* {Conference paper}

McFarlane, Sparrowhawk, & Heald, Y. (2002). *Report on the Educational Use of Games*. TEEM (Teachers Evaluating Educational Multimedia).

McMahon, M. (1997). *Social constructivism and the World Wide Web - A paradigm for learning*. Paper presented at the ASCILITE conference, December 1997. Perth, Australia.

Moersch, C. (1999). Levels of technology implementation: An inventory for measuring classroom technology use. *Learning and Leading with Technology, 26*(8), 59-63.

National School Board Association (2007). *Creating & connecting: Research and guidelines on online social — and educational — networking*. Alexandria, VA.

Prensky, M. (2001). *Digital game-based learning*. New York: McGraw Hill.

Shaffer, D. (2006). *How computer games help children learn*. New York, NY: Palgrave Macmillan.

Tinker, R. & Xie, Q. (2008). Applying Computational Science to Education: The Molecular Workbench Paradigm. *Computing in Science and Engineering, 10*(5), 24-27.

Trent, S., Artiles, A., & Englert, C. (1998). From deficit thinking to social constructivism: A review of theory, research, and practice in special education. *Review of Research in Education, 23*, 277-307.

Appendix

The i^5

An Individualized Inventory for Integrating Instructional Innovations

PROJECT TITLE: ______________________________

STEP 1: Identify the Project's Distance from Current Instructional Conditions

Increasing Distance from Current Practice/Resources

	THE CONTEXT (School)		
3	Little or no peer support exists from fellow teachers through occasional collaboration and accommodation of the teacher's project in their instructional setting.	A weak or no human infrastructure exists, lacking in responsive technical staff (translators), supportive administration and/or policies on technology issues.	A weak technological infrastructure exists with little access to computer labs, little ability to acquire necessary tools, and no freedom to control the technology involved.
2	Moderate peer support exists from fellow teachers through occasional collaboration and accommodation of the teacher's project in their instructional setting.	A human infrastructure exists with moderately responsive technical staff (translators), supportive administration and/or some policies on technology issues.	A moderate technological infrastructure exists with some access to computer labs, some ability to acquire necessary tools, and little freedom to control the technology involved.
1	Strong peer support exists in the form of teams or venues in which teachers can collaborate on and accommodate the teacher's project in their instructional setting.	A strong, healthy human infrastructure exists with responsive technical staff (translators), supportive administration and policies on technology issues.	A strong technological infrastructure exists with access to computer labs, ability to acquire necessary tools, and freedom to control the technology involved.
	ORGANIZATIONAL CULTURE/SUPPORT	HUMAN INFRASTRUCTURE	TECHNOLOGY INFRASTRUCTURE
	RATING:	RATING:	RATING:

	THE INNOVATOR (Teacher)		
3	One or more of the technology component(s) of the project do not fall within the teacher's current abilities and understandings of technology.	The use of the innovation's components conflicts with the teacher's pedagogical beliefs. (Technology is seen as a peripheral component to instruction)	Teacher has no contact with technicians and administrators. Teacher is unaware of additional support resources to augment the project.
2	The teacher has limited proficiency with one or more of the technology component(s) of the project.	The use of the innovation's components is moderately compatible with the teacher's pedagogical beliefs.	Teacher has limited contact with technicians and administrators. Teacher is aware of the additional support resources to augment the project.
1	The technology component(s) of the project falls within the teacher's current abilities and understandings of technology.	The use of the innovation's components is very compatible with the teacher's pedagogical beliefs. Teacher is able to handle the changes in classroom environment from the onset of the project.	Teacher has contact with technicians and administrators. Teacher has numerous additional support resources to augment the project.
	TECHNOLOGY PROFICIENCY	PEDAGOGY-TECH PROFICIENCY	KNOWLEDGE OF RESOURCES
	RATING:	RATING:	RATING:

	THE INNOVATION (Project)		
3	Project deviates from school culture and pedagogical beliefs. Project is dependent on support or participation from several persons to succeed.	New technologies are required to complete the project. High level of dependence on the technology exists, as most of the technologies lie outside of the teacher's control.	Project is not derived from an existing project previously completed by the teacher and is a completely new educational experience for the teacher.
2	Project moderately deviates from school culture and pedagogical beliefs. Project has a low level of dependence of support or participation from others to succeed.	Small additions or upgrades of technology are required to complete the project. Moderate dependence on the technology exists, as the teacher has some control.	Project is similar to an existing project previously completed by the teacher, but consists of new educational experiences for the teacher.
1	Project does not deviate from school culture and pedagogical beliefs. Project is not dependent on support or participation from others to succeed.	No new technology is required to complete the project. Little, if any, dependence on the technology exists, as the teacher has nearly full control.	Project is derived from an existing project previously completed by the teacher, or is a variation of prior educational experiences for the teacher.
	DISTANCE FROM SCHOOL CULTURE	DISTANCE FROM RESOURCES	DISTANCE FROM CURRENT PRACTICE
	RATING:	RATING:	RATING:

	THE OPERATORS (Students)			
3	Students have no previous experience and/or abilities with the technology components of the project.	The project places the students in several new roles and/or responsibilities that the students have not already previously experienced.	Students have a negative attitude toward the innovation, expressing many concerns and anxiety toward their responsibilities for the project.	
2	Students have limited proficiency with one or more of the technology component(s) of the project.	The project places the students in a new role and/ or responsibilities that the students have not already previously experienced.	Students have a neutral attitude toward the innovation, expressing minimal concerns or anxiety toward their responsibilities for the project.	
1	The technology component(s) of the project fall within the students' current abilities and understandings of technology.	The project does not place the students in any new roles and/or responsibilities that the students have not already previously experienced.	Students have a positive attitude toward the innovation, expressing no concerns or anxiety toward their responsibilities for the project.	
	TECHNOLOGY PROFICIENCY	PROJECT-STYLE EXPERIENCE	BELIEFS / ATTITUDES	Total Score:
	RATING:	RATING:	RATING:	

STEP 2: Use the Rating to Generate Support Strategies

Possible ways to address this:	Possible ways to address this:	Possible ways to address this:	Possible ways to address this:	Possible ways to address this:	Possible ways to address this:	Possible ways to address this:	Possible ways to address this:	Possible ways to address this:	Possible ways to address this:	Possible ways to address this:	Possible ways to address this: