Games That Matter: An Agile Approach to Gamified Learning
Introduction

It is a widely accepted truism that ‘Experience is the Best Teacher’. Do a quick Google search for images related to this phrase you will find some variation of the quote attributed to such smart folks as Albert Einstein, Jack Kerouac, CS Lewis and even Kobe Bryant. But if it is such a widely held truth, why are we still teaching people out of books and testing their understanding with a one chance mid term or final exam? Every underdog sports movie ever made makes it clear that the progression from new athlete to super star is a journey of getting up time after time after being knocked down, and recovering from failure after failure before their eventual triumph. What if we could offer students a way to do something similar? What if we could let them learn by encouraging them to fail (even repeatedly) in a safe environment?

Video Games represent a fantastic method of doing just that. They can foster learning - not only because they are inherently fun and interesting - but because they offer a safe place for students to encounter realistic scenarios and repeatedly ‘experience’ real life situations. Better still, students can try out different solutions to problems and learn which approach produces the best results. In this clip (http://ed.ted.com/on/uk36wtoi) Jane McGonigal, author of *Reality is Broken*, posits that students learn better by actually taking a test than studying for a test because they get feedback on what the educator really finds important, what they got wrong, and where they need to improve. Games are *great* at doing this because they can provide immediate positive or negative feedback to the player which is a powerful teaching mechanism.

Games also offer limitless retry opportunities. If you’ve played even a few games you’ve had the experience of getting beat by a particular monster by trying what you’ve always tried. The monster seems ‘impossible’ or ‘really hard’ and you aren’t sure you will ever figure out the correct solution, but then, after you figure out the secret, that monster becomes ‘easy’ and you have learned how to overcome him. When you see that monster later in the game, the approach to beat him is second nature. By struggling and repeatedly failing, you have learned and you had fun doing it. In this way, educators can use games to teach students how to handle real life situations that will prepare them for a variety of situations they will encounter on the job or in almost any situation. Games give educators the ability to contrive realistic (even hard) scenarios that put students in a ‘safe to fail’ environment where they can test themselves and their approach to given situations. By failing over and over and eventually arriving at the right solution, students will build confidence in their knowledge and abilities before entering that situation in real life.

Games are also ideal for creating the conditions for optimal learning in the brain in most people. Neuroscientific research has discovered that moderate levels of stress stimulate the sympathetic nervous system, which results in optimal performance and neuroplasticity (the ability of neural connections to build and change). (See http://gsi.berkeley.edu/gsi-guide-contents/learning-theory-research/neuroscience/ for a more in-depth discussion and references). In fact, stress and cognitive performance are
related in an inverted U-Shaped curve called the Kaufer Curve, as shown in the figure below.

![Classic inverted-U curve](image)

This research indicates that people’s brains tend to focus and learn better when engaged in activities that matter. For most people, games provide a context of emotional engagement that matters “just enough” to create optimal conditions for learning, while avoiding the high-stakes, high-stress situations in real-life that may actually interfere with learning. Pushed too far (as in learning on the job in a real life stressful situations), people can panic, or have their flight or fight response triggered which is not optimal for learning.

This document attempts to apply these insights in learning theory and neuroscience to gamified learning in medicine. It provides a description of an example game scenario that would help medical professionals ‘learn by doing’ before they enter the clinical space. While the example deals with the medical profession, the reader will be able to see how virtually any environment can be simulated in a way that is instructional to the player.

To be effective, we hold the following to be true:

- Educational Games must be immersive, entertaining and need to quickly engage the player’s appetite for further consumption. In gaming parlance, they need to ‘hook’ the player within just a few minutes by leveraging gamification techniques and entertainment theory to deliver immersive and entertaining training games. In neuroscientific terms they need to engage people enough to create the conditions for optimal neural plasticity.
• Educational games must provide a high level of educational value relative to the time invested by players. In addition to being fun and engaging, educational games need to deliver tangible results through relevance, realism, and responsiveness. The games need to integrate formative and summative assessment and feedback mechanisms as natural aspects of the game environment and flow, and not distract from player engagement.

• Educational Games need to be tested early and often by target users and educators. First playable versions of games should be put in the hands of users within 60 days of a project kick-off. Frequent iteration on those playable versions and get to a Minimum Viable product as soon as feasible so that we are sure the games are connecting with, and teaching, the intended learner. By putting the user in the ‘co-designer seat’, we maximize the value of everything we build.

Engagement Strategy: The next generation of gamified training needs to be inherently interesting, pleasing to the eye, and ‘hook’ the user within 5 minutes or less of starting. Boring technical simulations or automated power point presentations are not as effective as they could be. The goal should be to deliver immersive games, that are fun. With any game, the first 5 minutes are extremely important. The entire tone of the experience and the user’s opinion is formed in that important window. Design teams should expend significant effort in delivering an introductory experience for each game that pulls the gamer into the game world, tricks their brain into thinking that the game world “matters,” and ideally makes them forget that this is actually a training exercise. We will prioritize engaging the user by presenting them with realistic and engaging scenarios in each game that user may encounter. For example, one game might start out with a nurse character approaching the player from a first person point of view and saying “Oh thank goodness! I’m glad you’re here. We need your help right away. Come with me!” Then that character will walk away urging the player to follow. In this way, the game pulls the player in to the world of the hospital, the world of the game, the world of the course. This will appeal to the player’s innate sense of wanting to help, wanting to figure out the problem… and wanting to engage.

Immersion strategy. A successful game-based training system should not rely on the fact that training courses have been made mandatory by a person of authority. That kind of extrinsic motivation will only ensure that people take the training, but it does not ensure that the course will succeed in teaching anything. Learners should want to play these games, and want to do well in them. When we achieve that, these games will be more effective at teaching, because they will hold the player’s interest, and immerse them in the subject of the course. In this manner, players will learn the underlying course material as a by-product of the fun they are having. The games will deliver important knowledge and simulated experiences that learners will be able to draw upon throughout their career. To achieve this immersion, players should be presented early on with motivating targets and goals to achieve.

Instruction Strategy: It is vitally important for game designers to work closely with instruction professionals to ensure that the game scenarios are realistic enough to engage
the user, provide learning context and challenges that are **relevant** to the topics being addressed, and **responsive** to players’ actions in a way that reinforces the concepts and skills being taught. Games should reward behavior that instructors think appropriate and provide negative repercussions to incorrect choices. In this way, the games will prepare players to face situations they will encounter in real life. As frequently as possible, game designers should engage a “go-to” Subject Matter Expert (SME) and feedback provider. For example, if you are making a game that simulates hospital activity, engage a medical doctor or nurse who can help control the game for accuracy as they are developed so that we do not have to wait for formal user testing sessions.

**Game Development Approach**

Agile Six uses a standard industry best practice approach to front end analysis, design, development, integration, storyboards, test, management, documentation, delivery, implementation and sustainment of gaming capabilities. We have learned from our experience in delivering dozens of games and large projects that the process described in the following sections is key to our success in all of these games. Our general approach is as follows:

a. **Front-End Analysis**: Starting with the project kickoff meeting, we will work with the instructional team to fully understand the goal of the individual training. We believe in being agile and responding to the latest information. We do not commit to any particular direction without data to support it - especially early on. What we will not throw out is a commitment to making these courses games that are fun. We use a kickoff meeting to drill down as specifically as possible to understand as clearly as possible: what is it we are trying to teach, and what are the best approaches to teach it? The best ideas are what matter, not where they came from. We will endeavor to understand the main goals and sub goals and we will design our development cycle to ensure we deliver on the most important things before turning our attention to secondary goals.

b. **Design**: Based on our understanding of the above, we will flesh out game designs to include learning objectives, and player tasks to fit the given game scenario. We will seek to establish a core game loop as demonstrated in Figure 1 as soon as possible.

Starting in the Design phase, and continuing into the Development phase, Team Agile Six will actively seek opportunities to leverage existing third party components and assets that will simplify development and maintenance costs and reduce time-to-market.

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c. **Storyboards.** Once we and the instructors are in agreement on game design direction, we will develop storyboards of art direction and begin to develop specifics of how each game lesson will be conveyed to players. We will tailor our game design in terms of tone and style with the identified end-user in mind. We will then test the storyboards with a sampling of the target end users. It is not enough to validate with ourselves or with course designers. A big lesson we have learned over the years is that *what designers think end users will do - and what end users actually do - are often very different.* We prefer to rely on data over opinion whenever possible.

d. **Development.** As agile developers, we believe in early delivery, and frequent iteration of playable material. While early design thoughts are important, more important is getting playable versions in the hands of target users so we can learn from watching them play. To support this early and frequent testing, we will assemble a first playable and subsequently a minimum viable product (MVP) as soon as possible, and continue to generate new playable builds at least twice per month after the second month. We will use temporary stand-in graphics, or even sketches so that the effectiveness of the game/course will begin to show as early as possible. We will seek to display the core game loop on screen as early as possible so that we and government evaluators can begin to see the potential of where the game is going. Then, over time, we will replace stand in art with higher fidelity art as needed to appeal to the target user.

Whenever possible, we will endeavor to tell a story or deliver an emotional feeling to the player. We will aspire to make players feel proud, happy, rewarded or other appropriate emotions for the given scenario. This will make players more engaged with the course, which will make them learn more readily.

We will use sound effects and music to increase the realism of the training environment as appropriate. In our example above, medical machines will beep, nurses will be paged, patients will cry, laugh, moan etc.

We will work continuously with course designers and our Subject Matter Experts throughout the process to ensure that the learning objectives are being met and are proper and correct.

e. **User Testing.** We will test, test and test again. Yes, we will do QA testing to eliminate bugs, but this is not what we mean. We intend to conduct user testing early in the development cycle, and we will continue testing at least once per month with target users to make sure we are on track with delivering our goals. We always ask users for their feedback, and we encourage them to be brutal and honest. We test in such a way that encourages testers not to worry about our feelings, and frees them to criticize at will.
f. **QA Testing.** We do as much automated testing as possible, and supplement that with actual hands on testing by QA professionals. It is imperative that we vet that our game works well, because it will be coaching medical professionals about how to behave, and we need QA to ensure that a bug does not lead to incorrect instruction. For this reason, we will engage Doctors, RNs and practicing charge nurses to test our games.

We will develop an Alpha Test Procedures document during the storyboard development process. This document will demonstrate our plan for verifying that the game meets all pedagogical and user experience requirements and behaves as a seamless integrated system. We will also provide instructors and SMEs with a gaming script that demonstrates that the game flow and mechanics, look and feel, and feedback and scoring elements satisfy the pedagogical objectives of each game. We will review the Alpha Test Procedures document and gaming script with the instructors and SMEs as part of an Alpha Review prior to conducting any Alpha testing of the game. After the Alpha Review, and after an Alpha version of the game has been developed, the Agile Six team will perform Alpha testing according to the Alpha Test Procedures document developed during the storyboarding phase. The Alpha tests will ensure that the Agile Six team is on track to deliver an exceptional game experience that meets all pedagogical and user experience objectives of the game. Finally, the team will develop a Beta Test Procedures document and submit it for review to SMEs and government stakeholders. Beta Testing will not occur until a successful Beta Review of the Beta Test Procedures document.

g. **Delivery & Implementation.** The Agile Six team will choose the game engine most appropriate to a given course. The game above would likely be developed on the Unity Platform. Unity is the best choice for this effort for two main reasons. First, Unity is the gold standard for rich interactive 3D game development that is targeted for multiple platforms. Unity provides a single development platform and integrated environment for the creation, debugging, testing, and compilation of a rich game experience that can be published or exported to a variety of runtime environments, including web, iOS mobile, and Android mobile devices. Unity also offers a number of options regarding the delivery of the game experience to users. Options include:

a. The method of delivery — i.e., games can be downloaded and played as a single module, or delivered via multiple packages that can be loaded “behind the scenes” as they are needed.

b. The mode of delivery — i.e., games can be downloaded and played as an independent executable, as one or more modules that run within a browser plugin, or as WebGL instructions and assets streamed to a browser.
The Charge Nurse Game – An example

Say for example that a hospital would like to train someone to become a Charge Nurse, and/or simply get a feel for how they would react in certain situations if they were in that role. The following example is what a Charge Nurse game-based learning system would look like. As you will see, the proposed game provides a rich training context in which a Charge Nurse learns to provide patients with personalized, proactive, patient-driven healthcare through advancing innovation trials, emerging health technologies and experimentation.

Game Basics:

- Single Player Game
- 3D simulation of a hospital floor with several hospital rooms, a hallway and a Charge Nurse station.
- Built using an off shelf 3D game engine such as Unity
- Multiple non-player characters will interact with the player based on scripted events.

The Charge Nurse Learning Game presents aspiring Charge Nurses with the opportunity to test out the role of Charge Nurse in a safe environment without being thrust into that role in real life before they are ready. The player assumes the role of a nurse that is almost, but not quite ready for promotion to Charge Nurse. He has never actually been a Charge Nurse but is confident that he can do the job. Then, one day, he comes into work to find that the normal charge nurse has called in sick and the other one who normally substitutes in that capacity is on vacation. Other nurses who are participating in the shift change routine all look to the player as the de facto Charge Nurse. Hospital HR has informed you that they are scrambling to call someone in, but you must perform the role until that person arrives. In short, this is your chance to serve as Charge Nurse.

Player Motivation

The basic motivation for the player is to prove to everyone that he is capable of performing as a charge nurse by keeping his or her composure in increasingly stressful situations. To do this the game would present the players with imaginary states of being to keep steady and improve over time. For example, if a real life group of charge nurses indicates that Personal Stress, Patient Satisfaction and Reputation are traits that charge nurses must manage every day, a charge nurse game can make those traits of being that the player must keep in balance by putting an on screen meter showing your current level of those three traits. Game scenarios would then put the players in situations that ‘test’ one of these states at a time, and the outcome of each scenario would cause the traits to improve or degrade based on player choices. As the game
progresses and gets more challenging; all 3 traits could be in play in a given scenario. In this fashion we can immerse the learner in the imaginary world of a functioning hospital, while asking them to keep track of a higher internal goal. The game scenarios provide “just enough” stress on the Kaufer Curve to create optimal learning conditions, while avoiding the “high” stress end of the curve that may attend real-life situations, in which high levels of cortisol might actually interfere with learning.

**Game Scenario**

There are several scenarios the player could experience in the Charge Nurse game (monitoring for quality, showing the way, balancing competing priorities, managing the flow, making a difference, putting out fires, and keeping patients happy). To bring these scenarios to life, we will thrust the player into lifelike situations that involve interacting with non-player characters. For example, if the goal of the ‘showing the way’ scenario is to lead the team by executing proper delegation skills, we could present the player with a series of assignments, and each time, the player would be faced with a choice: do I take on this task personally - or do I delegate it to another nurse? Through interactive windows, the player will choose which to do. If the player delegates too much, their personal stress meter will be low (good), but their reputation among other nurses will also decline (bad), and patient satisfaction will be adversely affected (really bad) because overworked nurses are cranky and making mistakes. Or, if the player delegates a task that is above the capability of a Jr. Nurse, it would be a big mistake and result in increased personal stress, decreased reputation and decreased patient satisfaction. The formative portion of this game could provide instant coaching via feedback windows. “Assigning that particular task to a Jr. Nurse appears to have really stressed her out. Be sure to consider your team’s capabilities before assigning them any work.”

Balancing these scales gives us the opportunity to get Charge Nurses to operate within the guidelines of what educators find appropriate. Via playing this game, nurses will start to understand the types of tasks that can and should be delegated, the amount of tasks that should be delegated, and how much the Charge Nurse should take on for himself.

Over the course of the game, various scenarios will be set up and the player will be presented with opportunities via dialogue choices to enable educators to instruct on preferred policy. For example, one scripted scenario could involve the player coming into a room and seeing two nurses arguing. When they realize the player is there, they immediately turn to you and ask you to resolve the dispute by picking from options: 1) side with Joan, 2) side with Jill 3) suggest we drop it 4) suggest we move to a different room and discuss out of earshot of the patient.
The outcome of each interaction would be scripted dependent on how educators would prefer to handle the situation and what they are trying to teach.

The above are contrived scenarios for illustration purposes, but the reader can see that using real-life situations that Charge Nurses have actually experienced lends extra realism to the game world. In each scenario, the game will reward the player for choosing the desired response, and penalize them if they choose an incorrect response by causing one or all of their three tracking meters to go in an undesired direction.

Over time the game could be expanded modularly to address such skills as

- Act as a change agent
- Create an environment of empowerment
- Demonstrate humility
- Describe policies and procedures
- Develop a vision
- Develop flexibility
- Develop self-knowledge
- Develop specialized practice activities
- Develop specialized units
- Discover the sign-posts
- Formulate innovations
- Identify policies and procedures
- Plan quality improvement strategies
- Practice conflict management skills
- Practice creativity
- Practice critical thinking skills
- Practice customer service skills
- Practice inspiring and leading change
- Practice leadership training skills
- Practice mentoring skills
- Practice relationship building skills
- Practice research development activities
- Practice risk management skills
- Practice strategic planning
- Practice supervision skills
- Practice systems thinking
- Practice team building skills
- Recognize conflict as opportunity to change
- Show delegation skills
- Show personal mastery
- Support staff through change
- Use communication skills
- Use financial management skills
- Use human resource management skills
- Value chaos and complexity

Player Reward
Players will find it fun and rewarding to see decisions they make keep their stress meter low, their patient satisfaction and reputation among staff meters high. At the end of the game, in a final summative moment, the Chief of Staff character could come to the player and say, "I was watching you today and I'm happy to say that I'm impressed! I'll be happy to write a recommendation letter for you if you are interested in applying for a charge nurse position". Alternatively, if the player’s 3 meters are in poor states, the Chief of Staff might say, "Hey, thanks for helping out today, seemed like it was a little rough on you. Don’t worry, this was valuable experience. I’m sure next time it will be a little easier for you".

Conclusion
At Agile Six, we believe that gamified learning is the future of advanced education. Learning disguised as games provides a safe place for students to experiment with a variety of solutions and learn the pros and cons of various approaches (often fail) in a safe environment. By creating life-like situations that convince the learner’s brain that
the situation is ‘just real enough’, it creates an ideal physical state for learning. Then, by engaging and immersing the learner in the world of the ‘course’ the student will learn as a byproduct of the fun they are having, and be better prepared for tough situations when they encounter them in ‘real life’.

**Recommended Reading**
Article on gamifying training courses:

http://elearningindustry.com/6-tips-to-gamify-compliance-online-training-courses

You Tube video illustrating how allowing an opportunity to try, fail and learn in safe environment is powerful and improves learning:

http://ed.ted.com/on/uk36wtoi
About Agile Six Applications
Agile Six Applications, Inc. was established to serve those who have bravely served our country. We are passionate about our mission to improve the lives of veterans and their families by delivering world-class software solutions. Our collaborative and highly transparent Agile development process invites users and program representatives to participate in the development process, and results in better solutions, delivered more quickly, at a lower overall cost. Our firm was founded in 2014 by former executives from the federal and commercial space (i.e. DefenseWeb & Amazon) in direct response to the formation of the US Digital Services where “America’s most capable problem solvers are striving to make critical services — like Healthcare, student loans, and Veterans’ benefits — as simple as buying a book online”. As such, we actively promote the tenets of the CIO Playbook:

Digital Service Plays [4]
1. Understand what people need
2. Address the whole experience, from start to finish
3. Make it simple and intuitive
4. Build the service using agile and iterative practices
5. Structure budgets and contracts to support delivery
6. Assign one leader and hold that person accountable
7. Bring in experienced teams
8. Choose a modern technology stack
9. Deploy in a flexible hosting environment
10. Automate testing and deployments
11. Manage security and privacy through reusable processes
12. Use data to drive decisions
13. Default to open

Please visit www.agile6.com for more information.

About Ernie Ramirez
Ernie is an experienced entrepreneur having played a central role in co-founding 4 successful businesses. In 2008 Ernie and his partners sold their Game Studio to Amazon.com. During a six year tenure with Amazon, he served in the capacity of Executive Producer and then Studio Head of Amazon Game Studios, Orange County overseeing the development and release of over 20 game titles including Amazon's first internally developed games for iPhone, iPad, Android phones and tablets, Kindle e-readers, Kindle Fire Tablets, Fire TV and Fire Phone. Ernie is currently the Chief Operations Officer at Agile Six Applications, Inc.

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