Chapter Three: Gamification in the Classroom: Old Wine in New Badges

Katrin Becker, Mount Royal University, Calgary, Alberta, Canada, becker.minkhollow@gmail.com
Scott Nicholson, Wilfrid Laurier University, Brantford, Ontario, Canada, scott@scottnicholson.com

Key Summary Points
1. Gamification is a term for a collection of activities that use game elements for non-game purposes.
2. Teachers have already been using game-based activities to engage students for centuries, so while some of the methods and mechanisms used are different, the underlying concept is not novel.
3. There are two levels of gamification that teachers can use. Reward-based gamification is the use of reward-based systems to accompany or replace grades as a way of measuring progress in the classroom. Meaningful gamification is the attempt to use game mechanics to engage students more deeply in the concepts in the classroom.

Key Terms
Gamification
Gamify
Leaderboards
Motivation
Games in the classroom
Badges

Introduction
The term "gamification" is relatively new, but its exact origins are not known. The first recorded use was in the digital media industry in 2008 and it has become popular in the last couple of years (Deterding, Dixon, Khaled, & Nacke, 2011). A search performed in October 2012 on Google Scholar using the term "gamification" turned up over 1,000 publications, and the same search in May 2014 produced over 7,000 publications. 80,000 people were registered in the Coursera Gamification course in Sept/Oct 2012 (Werbach, 2012). The attention that gamification gets from industry, as well as from the public, makes it one of the newer concepts of the use of games in the real world to surface in recent years. This chapter analyzes the potential and limits of gamification for learning and classroom use.

Gamification can be broadly defined as the application of game features and game mechanics in a non-game context, but does not typically include using actual games. In the most commonly promoted approach to gamification (Zichermann & Cunningham, 2011), designers seeking to create a gamification system first identify behaviors that are to be encouraged, and then assign rewards to that behavior. These reward systems can take different forms—points, achievements, and badges are three typical tools for motivation and manipulation.

The concept of using rewards to modify behavior is nothing new to teachers in a classroom setting. Teachers often use point systems for both learning and behavioral goals. If one takes into account the concept that the absence of a punishment is the same as a reward (Kohn, 1999), then teachers have used reward-based systems as the core of classroom management for centuries. The syllabus in the classroom is a gamification layer that is used to motivate students' involvement in course content.

If we consider the concept of levels in games, then certainly the grades (K-12) and years (freshman, junior, senior, sophomore) of formal education are the very embodiment of "levels." There are known requirements for completing one level and just like in games, each new level opens up new content and additional options. The idea of earning badges within a game as a means of marking achievement is also not unique to games. Children in elementary school often get stickers for completed work; both the Boy Scouts and the Girl Guides (as well as a great many other organizations) use badges to symbolize various achievements, and of course, medals and badges have been a longstanding tradition in militaries throughout the world. The notion of leaderboards is also not unique to videogames, or games of any sort

for that matter, as they can be found in many businesses as ways to highlight sales records for example, and in schools to commemorate a myriad of achievements academic and otherwise. Even the concept of a letter grade is remarkably similar to a badge, as it indicates achievement in a standardized way that has meaning outside of the learning environment.

Some applications of gamification go beyond merely using rewards such as points, badges and levels to motivate. Meaningful Gamification is the concept of using elements from games to help participants find a personal and meaningful connection within a specific context. Many of the theories behind meaningful gamification are educational theories such as Universal Design for Learning and motivational theories, such as Self-Determination Theory. These theories provide ways to use concepts of play, reflection, and narrative (instead of rewards) to engage learners (Nicholson, 2012a).

Teachers have used game-based elements for the real world application of teaching content for decades. While the term of gamification is new, the underlying concepts for both reward-based and meaningful gamification have been explored in the classroom for some time. In this chapter, we will review different models for gamification in the classroom, explore some of the benefits and hazards to using it, and present some case studies and best practices for instructors to use.

The goal of this chapter is to explore gamification in the classroom from different perspectives and present guidance to instructors looking to use elements of games and play to improve learning motivation.

Key Frameworks
In this section, some frameworks useful in thinking about gamification in the classroom are explored. First, the elements of a game are presented in line with the elements of the course. This leads into a comparison of the 20th and 21st century classroom and ways that gamification can be integrated. After this, the frameworks of reward-based gamification and meaningful gamification are compared along with theories of self-determination theory. This framework review concludes with the discussion of importance of reflection in classroom gamification.

At its heart, gamification is about taking elements from games and applying them to non-game settings (Deterding, 2011). While many look at modern video games as a key inspiration for gamification, central elements (see Figure 1) such as points and levels come out of tabletop roleplaying games. While no one has yet succeeded in coming up with an undisputed definition for "game," most would agree that to be considered a game, it must include at least the following aspects:
1. **Interactivity:** If there is no way for the player to affect change on the system; if there is nothing for the player to actually do, then it ceases to be a game.
2. **Rules:** A mechanism to constrain the behavior of players in pre-specified ways.
3. **Goal(s):** One or more objectives that players pursue while interacting with the game
4. **Quantifiable measure of progress (or success):** This can be as simple as a binary acknowledgement of completion, or as complex as a set of cricket scores.
5. **Definite ending:** While some applications commonly referred to as games do not have clear endings (*The Sims*, for example), most games have a clear endpoint.
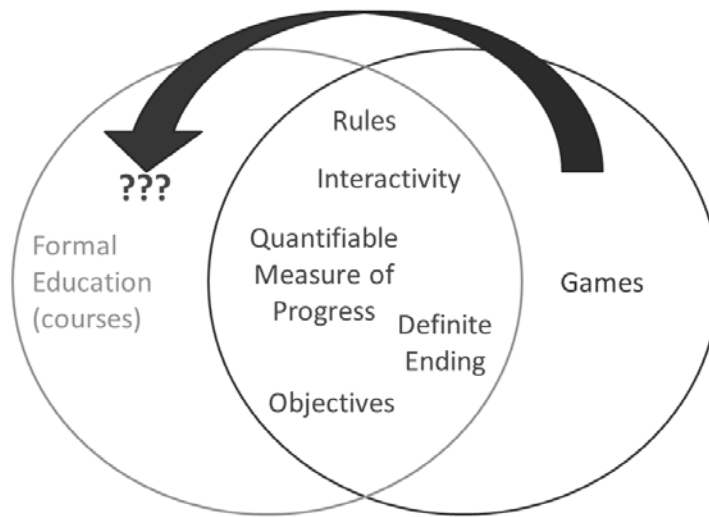
Figure 1. Essential Game Elements

By this measure of game, it could easily be argued that a formal educational course meets these criteria. Does that mean that all formal educational courses are games? We will leave that discussion for a different venue, and suggest that there is more to a game (and a course) than this. However, this list offers a convenient starting point for our discussion. In a conversation about computer science as a discipline, Kurt Guntheroth explained that, "CS may be more than programming, but it is not less than programming." (in Crawford, 2004) The same can be said of both games and of formal education. Both are more than these criteria, but neither is less. Thus, if the elements listed above are insufficient to describe either a course or a game, then what are we adding to education when we are gamifying it (see Figure 1).

Like most new approaches, gamification has both champions and detractors. Critics such as Ian Bogost (2012) complain that gamification often takes "the least essential aspects of games and presents them as the most essential"(p.2). He describes it as little more than "pointsification" designed to motivate participants with superficial rewards and refers to it as exploitationware (Bogost, 2012). Nicholson (2012) provides the term BLAP to describe the set of Badges, Levels and Leaderboards, Achievements, and Points that can be easily applied to many settings in educational, corporate, and non-profit sectors alike, while Charles, et al. (2011) simplify the term gamification even further to convey awarding "points to students for the successful completion of tasks throughout the course of study" (p.638).

What most of us see when we play a game is simply the veneer—in other words, what we see are the graphics and the visualizations of the player's progress. Appropriating this veneer of video games and applying it to formal educational settings is novel, but is that all there is to gamification? To highlight the novel approaches to education that can be accomplished through gamification, it helps to compare it to the current thinking on 21st century teaching and learning. Each one of the approaches listed in the right-hand column of Table 1 can be embodied in a meaningful gamified course design.

Table 1. Comparison of 20th vs 21st Century Approaches to Teaching & Learning

20th Century Classroom	21st Century Classroom
Time-based	Outcome-based
Focus: memorization of discrete facts	Focus: what students Know, Can Do and Are Like after all the details are forgotten.

Passive learning	Active Learning
Learners work in isolation	Learners work collaboratively
Teacher-centered: teacher is center of attention and provider of information	Student-centered: teacher is facilitator/coach
Little to no student freedom	Some freedom toward meeting common goals
Fragmented curriculum	Integrated and Interdisciplinary curriculum
Grades averaged	Grades based on what was learned
Numerical or letter grades scores averaged over all work.	Grades can be cumulative based on performance.
Typically one chance for assessment per task.	May allow for resubmission; repeatable tasks.
Teacher is judge. No one else sees student work.	Self, Peer and Other assessments. Public audience, authentic assessments.
Literacy is the 3 R's – reading, writing and math	Multiple literacies
Driven by the NCLB and standardized testing mania.	Driven by exploration, creativity and 21st century skills

Adapted from Shaw, A. (2008). What is 21st Century Education? Retrieved from http://www.21stcenturyschools.com/what_is_21st_century_education.htm on Mar. 2, 2015. Used with permission).

One of the recent guidebooks to gamification in the classroom is Lee Sheldon's *The Multiplayer Classroom* (2012), which takes many elements from massively multiplayer online roleplaying (MMORPG) games. These include:
1. Flexible point systems, where students can take on different tasks to earn points.
2. Solo and team challenges and quests that allow students to choose different ways in which to engage with course material.
3. Duels where individual or groups of students are in direct competition.
4. Boss fights, where the entire class needs to work together to accomplish a challenge.

While some of the specific mechanics presented in Sheldon's book are new ideas, the underlying concepts are those of the 21st century classroom. The novelty of presenting a system with a narrative layer will excite students at first, but unless that system is meaningfully connected to course content, the students will quickly realize that the underlying activities are the same as in a traditional classroom (Nicholson, 2013). This concept of meaningful gamification is presented later in this section.

Many of the claims about the motivational effects of a game-based system can also be accomplished and have been done in the past through good educational design. For example, the rubric-driven classroom uses challenge-based learning, where each topic, concept, or skill is described and students are given points as they demonstrate proficiency (Becker, 2004; Wiggins & McTighe, 1998). Stickers, reward and incentive charts have been used in elementary schools for decades.

The educational theory of Universal Design for Learning is based upon the concept that different learners use different methods to demonstrate competency, based upon their own skills and abilities (Rose & Meyer, 2002). In her first year computer programming courses, Becker (2006) facilitated that by setting up assignments that not only allowed for students to choose from among numerous tasks, but also permitted a potential total score that was above 100%. Thus, the use of points, repeatable assignments/quests, resubmission of assignments for a better score—hallmarks of gamification—are not new to education. Even levels are not unique to games: the one-room schoolhouse model had students at different levels working in the same learning space.

Many of the elements of gamification are just new names for traditional concepts:

1. course requirements = game objectives
2. policies / regulations = rules
3. assignments = quests
4. grades = experience points (XP)
5. passing course = winning the game

While the term gamification offers a convenient and potentially powerful means of organizing a collection of design elements, techniques, and approaches, many of the ideas and underlying educational concepts that are part of gamification are not new to classroom teachers.

Meaningful vs. Reward-based Gamification

Much of what has been discussed so far is reward-based gamification, in other words, gamification where the underlying instructional concepts remain the same as in the traditional classroom and where the game elements are used as a reward or motivational tool. Reward-based gamification is also seen in many bad quiz-based educational game designs that use bits of the story or other game mechanisms as a reward. Some examples of these poor models are:

1. Players travel through a maze, and must answer a question to continue.
2. Players roll a die and move on a board and answer questions from cards.
3. Players answer questions to then play part of a driving or shooting game.

Meaningful gamification, on the other hand, is the use of game elements to help participants find a personal connection to a non-game setting (Nicholson, 2012a). This concept is based on Mezirow's model of transformative learning, which hinges upon the learner taking an experience and connecting that experience to previously-held beliefs. This is how the user finds meaning in the external context. It is through making these connections that the learner can then be opened to change (Mezirow, 1991), and it is this long-term change that is the goal of meaningful gamification. While reward-based gamification is about extrinsic motivation, meaningful gamification is about developing intrinsic motivation so that the interest in the subject may continue after the learner is no longer motivated through game elements.

Instead of relying upon rewards, meaningful gamification is about using concepts like player-created narratives, authentic play-based experiences, and reflection through debriefing, to help build meaning for the student. Some of the aforementioned concepts, such as allowing players true choice in developing their paths of learning and creating failure-safe spaces, can create opportunities for meaningful gamification. The underlying concept is that the system needs to create affordances for different types of learners to find personal connections to the underlying context.

While meaningful gamification is a new term, it is built upon concepts and educational theories that teachers have been using to engage students (Nicholson, 2012a). To guide those wanting to use meaningful gamification, the pneumonic RECIPE can be used for six ways of creating game-based layers (other than rewards) that can be used to motivate learners:

1. **Reflection:** Provide learners with opportunities to consider what they have been exposed to and how they can connect it to their past experiences.
2. **Exposition:** Use narratives, either generated by the gamification designer or by the participant, to help the students find connections between the context and their lives.
3. **Choice:** Provide learners with decisions as to how they will explore the content.
4. **Information:** Provide learners with context and information about their decisions and actions to help them make a stronger connection to the real world.
5. **Play:** Create spaces where learners can try, fail, and try again as a way of exploring.
6. **Engagement:** Develop connections between users to help them learn why other students find the context to be engaging, thus making it more likely they will make their own connections.

Rather than using reward-based game elements as extrinsic motivation, meaningful gamification is about creating game elements that motivate the user by building his or her intrinsic motivation (Nicholson, 2012a). When meaningful gamification employed properly, learners are able to connect the course material in ways that are personally relevant and meaningful to them and will want to learn instead of

being manipulated through rewards to perform.

Learning in the 21st century requires that learners recognize the importance of their own learning and are motivated to achieve and value their learning. They must take an active role in meaning making and the process of learning. In particular, learners need to
- want to learn,
- become aware of themselves as learners, and
- able to take responsibility for their own learning both in and out of school over their lifespans.

"Without a serious focus on students' ownership of their own learning processes, there is always the danger that the focus will be on curriculum delivery and teacher strategies which are less likely to stimulate the sorts of intrinsic motivation for learning which is so necessary for life in the 21st century." (Deakin-Crick , et. al., 2005).

Self-Determination Theory and Potential Problems with Gamification
At the core of meaningful gamification is the concept of Self-Determination Theory. Self-Determination Theory states that for a learner to have a positive mental outlook toward engaging with something, they need to feel like they believe they are able to make choices based upon their own values and interests, that they confident and effective in engaging with the world, and that they feel that they are connected to other people and have a sense of belonging (Deci & Ryan, 2002).

One of the problems with gamification in the classroom is that students who do not like this approach may not have a choice to engage in the gamification. While gamification systems can be developed to give students a choice of paths through the classroom content, not all students want to engage with a game structure when they are learning. A key aspect of the concept of play is that play is optional, so for something to truly be play-based, a learner needs to be able to choose not to play. This concept falls in conflict with many classroom settings. If an instructor chooses to add a game layer to the classroom, it can be difficult for a student to opt out of the game layer and participate in class in a more traditional way. Forcing all students to engage with game elements can run counter to the flexibility the game-based system can provide.

Many games are based around the concept of direct competition, so some gamification elements, such as leaderboards are built around putting the players in competition with each other. These game elements highlight the fact that some students succeed while others fail. The same ranking that drives some students to push on and succeed can also demotivate students who realize they are not making progress and do not have a chance to catch up compared to the other students. In fact, it is these students—the demotivated ones—who need the most support; leaderboards tend to support the students who would do well in the class without one. The same can be said for a public display of badges; students who are doing well can be driven to continue to gain more badges, while students who are struggling watch as their classmates accumulate more and more accolades while they are just trying to get started (Kumar & Herger, 2013).

Key Findings
In this section, some key findings about gamification in the classroom are discussed. First, concerns about the use of leaderboards and the impact of competition in the classroom are explored. After this, the concept of using badges as signposts instead of a reward is presented. The concept of using narratives to help students engage with course content is then proposed, and finally the ever-important topic of assessment is discussed.

The Importance of Reflection

Gamification can provide short-term motivation to get students engaged with a topic
that they might otherwise avoid. But without encouraging reflection on the topic, some students may not ever connect what they are learning to the real world (Mezirow, 1991). Students who are chasing badges

and achievements briefly engage with an activity and then put it aside as they rush toward the next goal.

It is important to create moments where learners stop and reflect upon what they are learning. Reflection creates a moment for a learner to become self-aware of content and then consider why that content is meaningful. This can be done by helping learners to connect this new material to something they are already familiar with. Many of today's games can teach real world skills like resource management, planning, communication, and economics. Without some trigger to help players recognize how what they are learning applies to the real world, many players will engage in the narrative and the created world and not make that external connection (Nicholson, 2012b). As the learning theorist Dewey said, learning comes from doing something, and then reflecting upon what has been done (Dewey, 1916).

Leaderboards and Competition
Both Nicholson (2013) and Becker (Becker & Perri, 2013) have explored the use of leaderboards in courses as a way of motivating students through creating a competitive environment. In both cases, the identities of students were not disclosed on the leaderboards. Nicholson (2013) required each student to create an avatar for the class while Becker presented a list of scores with no identification information attached. Both found that those students at the top of the leaderboards were also top performers in the class without the leaderboards, which may suggest that the use of the leaderboards did not appear to have an effect on motivation or performance of the high achieving students.

There was a distinct difference between these two experiments for the lower performing students. Becker (see the case study by Becker) found that leaderboards helped all of her students to succeed in the classroom and pushed many of them to work above and beyond class expectations. Nicholson (2013) found that the leaderboards demotivated about half of the class to the point where many students had stopped turning in any weekly assignments by the sixth week of the class. In talking to his students, Nicholson learned that many of them felt that they had no chance of catching up with the high-performing students and were planning to drop the course. Some of the mid-performing students noted that there are low-performing students who had stopped engaging with course content, which then discouraged the mid-performing students to continue working.

Both classes were online classes consisting of mostly or all graduate students. The major difference was the identification of individuals in the leaderboards, as Nicholson's model allowed students to identify themselves easily by tracking their avatar. This drew focus to the competitive nature of the leaderboard in a way that Becker's model did not. As it was more difficult for students to identify their own position in Becker's leaderboard, it served more as an overall measure of class performance.

Badges: Signposts instead of Goalposts
One of the gamification elements that has drawn significant attention are badges. The fourth Digital Media & Learning (DML) Competition, sponsored by HASTAC, the MacArthur Foundation, and others, focused on the creation of badge systems for lifelong learning (2011). Another badge system that has gained attention is Mozilla's OpenBadges, which is designed as a way for people to receive and display badges granted by different organizations (Mozilla, 2013). The Mozilla concept is that a learner has a Badge Backpack that can collect and hold badges that have been granted by different systems and groups. The learner can then share the contents of the backpack with others as a certification tool or a way to demonstrate a pathway of learning.

As previously mentioned, the letter grading system can be seen as a type of badging system. Teachers assign letter grades and these grades have meaning outside of the classroom. Students share these "badges" with other schools and future employers to demonstrate their skills. The importance of letter grades has created a system where it is difficult to get students to work on something that does not lead to a grade; this is one of the problems that gamification is purported to address. Will gamification just end up creating the same problem as grades, where students will not engage with coursework unless they can earn a badge?

One of the advantages that badges have over letter grades is that they can be more specific in reflecting what the student has learned. Instead of just an overall grade of "B" in math, badges can show the

specific pathways that a student has followed. Earning badges of different levels for topic areas also allows learners to demonstrate areas of strength and areas of competence. The badges can thus be thought of as a series of signposts toward a student-selected goal, which increases the learner's sense of autonomy.

Narratives, Avatars, and Other Veneers
Just as gamification can be reward-based or meaningful, the use of a narrative overlay with a classroom activity can be either used as a reward or used to help learners create meaning. Many older learning games used a narrative that had little to do with the underlying activity, making it superficial. In these cases, the experience of the narrative was used as a reward for completing a task and served little purpose other than to lure the players to the next activity. In other words, the narrative was used like a carrot, tempting the players to answer the next quiz question correctly to see the next part of the story. This is also an example of what Becker (2012) calls the "Decorative Media Trap" the mistaken belief that appealing visual or superficial aspects of a design imply a depth or substance that does not actually exist.

Narratives can be used in ways that are much more meaningful, however. A well-chosen narrative can deepen the student's understanding of a topic by providing the "why" to the "what" he or she is learning. Narrative can also be used as analogies or parables, but for these to be effective, the student must be led through a reflective exercise where connections between the narrative, the content, and the real world are drawn. For example, a grade four unit on flight might include a narrative that makes the students members of a design team tasked with creating a particular kind of airplane, or as explorers attempting the first trans-Atlantic crossing.

Another way of using narrative in a meaningful way is to allow the student the ability to write some of the narrative. Nicholson teaches a class on presentations, and the class was initially designed to teach generic business-style tasks of giving talks and making basic documents. To incorporate a narrative to the class, he greeted the students on the first day as new employees to the company and had them create a short video introducing themselves and speaking on a randomly-selected topic. Students then needed to select the company for which they pretended to work all semester; companies like Microsoft, the NBA, and Chipotle were quite popular. To take this narrative further, in a future semester, students will need to identify their favorite company, and then start a competing company (with appropriate budget) and work on presentations and design elements that will successfully compete with their favorite company. In this way, all of the assignments in the class have meaning, and the use of narrative creates an expectation as to what level of quality is expected in the assignments.

Assessment
Assessing the efficacy of a gamification system and course design is always difficult. Student reviews are one way of assessing whether our course design has made things better or worse. Retention and attrition rates are another method, as are measures of student success in subsequent courses. We can also attempt to measure whether students learn better using this approach than they do in traditional classrooms, but unless the learning tasks are identical, it is difficult if not impossible to obtain a reliable result. We rarely have the luxury of a control group against which we can compare results, although occasionally such an opportunity presents itself. At Mount Royal University in 2013, one of four sections of a first year introduction to computing course was gamified, while the other three sections were taught using a more traditional approach. The gamified section was too small to conduct a statistical analysis, but informal student surveys conducted approximately mid-way through the term indicated that students in the gamified course showed greater confidence in their ability to be successful in the course than students in the non-gamified sections (Becker & Perri, 2013).

There is a growing interest in using gamification itself as part of the assessment tools in a class. As a tool for formative assessment, or assessment used to monitor student learning, gamification can be valuable, especially when using concepts like signposts instead of goalposts, as discussed in the previous section on badges. Instructors can then more easily grasp the progress that students have made through the class and the students can get a better understanding of why they are learning the current topic and where it can lead. Using a badge as a reward for the end of a content unit is similar to summative

assessment, while having a series of badges for smaller steps that lead toward a larger goal is similar to formative assessment.

Some instructors, such as Sheldon (2012), use the concept of a Boss Fight (like a final exam) as a way to use a game element as a summative assessment. In video game terms, the Boss Fight is a challenge at the end of a chapter of a game that requires the player to demonstrate competency in game skills to continue on with the game. This idea of encouraging students to play a game, and then use the results of the game as the students' grades is an attractive idea, but has a significant problem that is rarely stated related to the aforementioned concepts of play and failure.

The power of play and games comes from the freedom to fail. Using games for a high-stakes grading moment in a class creates a conflict between "game as failure-safe play space" and "game-like thing that actually matters." In the video game model from which the idea of the "Boss Fight" emerges, players are able to re-attempt a big battle until they succeed; however, this is not true if the game is being used as the summative evaluation for a course. This break in the analogy is something that should be addressed explicitly with the students. One concept in games that might be useful is that of "hardcore mode" or "permadeath." In these game modes, the players' actions have permanent consequences. This creates a more intense game experience for players who are ready for a challenge, and this moment in a game can be similar to the moment in a class where the students face an important challenge.

In the approach used by Becker in 2013, the "Boss Battle" was simply the name given to the final exam, but because students had had the opportunity to earn more points all through the term than were needed for a perfect score, the "Boss Battle" did not carry the same significance as an exam normally does, and in fact of the three students who already had sufficient points to earn an A+ before the final, one student opted not to write the final exam at all, while the other two wrote the exam just as a way to check their own knowledge and just to see how high a score they could earn (Becker & Perri, 2013).

Future Needs

The biggest challenge to an educator using gamification in the classroom is time. Gamifying classroom activities can add on additional time to create and maintain a narrative; to track the students' progress in many different ways; to communicate these different points, levels, and badges to the students to provide the depth of feedback needed to allow students to successfully re-do an assignment; and to re-grade assignments. Just as the novelty of a reward-based game layer can engage students in the short term, the novelty of creating these game layers can engage an instructor in the short term. But in the long term, many instructors will tire of the extra workload that gamification in the classroom creates.

To aid with this, there are learning management systems being developed with gamification elements already integrated into them (Holman, Fishman and Aguilar, 2013). One of the challenges of using a non-traditional grading system is helping students understand where they stand in the class. If the instructor uses the Multiplayer Classroom system where students start at 0 and work their way up through the letter grades (Sheldon, 2012), then they will have an F for a large portion of the class; this can cause an issue with mid-semester grade reporting. To deal with this, LMS gamification systems present students with the ability to see different future scenarios. Students can adjust values and sliders based upon how they think they will do, and can see what this will do to their grade. Nicholson (2013) found that the students' frustration with understanding their class standing was not worth the gains in having a grading system that started students at 0 points, while Becker (2013) developed her own grading system using spreadsheets, and students had no difficulty understanding their class standing. Additionally, Becker's students reported that they appreciated being able to see where they stood in detail any time they wanted, however, a key requirement was that the students' scores be updated frequently.

One advantage of a learning management system designed for gamification is that the system can assist teachers in the design of a course. By embedding different types of reward-based and meaningful game-based and play-based layers, teachers can more easily try out different gamification techniques in their class. The system can also provide information as to what types of game elements might be good for different types of class activities and what risks the instructor and students may face when using the system.

A well-designed gamification system can also add to the game-like feeling of a course environment. If students see a system that looks like a traditional LMS or outdated Web site, then the teacher will have to work harder to help students realize that the class experiences are different and exciting. If the students come into a graphically gamified system that looks like a game, they are more likely to approach the class with an open mind and a playful spirit.

These systems can also help instructors deal with the logistics of a complex assignment system. To provide students choices between assignments, it means that the tools needed to track these assignments will have to be flexible to allow different grading structures and class situations where different students are working on different aspects of the course at the same time. These systems can also help with situations where some assignments allow students to work alone or in groups alongside classroom situations where the class comes together to take on a large-scale challenge.

Case Study One: Meaningful Gamification Course (Written by Scott Nicholson)

The Meaningful Gamification course, taught by Nicholson, was a split-level non-required course with graduate students and undergraduate students, and was conducted via Blackboard.

The Meaningful Gamification course was taught as part of the School of Information Studies at Syracuse University in the Fall of 2012. The goal of the class was to help students explore reward-based gamification and meaningful gamification. It was an optional class, so was taken by students in different departments, such as Education, Computer Science, Design, and Information Studies.

When students started the class, they were greeted with a course model based off of the one developed by Sheldon (2012). Students started on the "Quest for Mount Gamification" at the base of the mountain, and their points in the class equated with gaining height (levels) of the mountain. At certain levels, the students moved into a new grade bracket. The students had a variety of tasks they could choose to take on each week to earn points; most tasks were optional, although some were required. During the first six weeks, the readings for the class focused on?? reward-based gamification and students learned how to create a reward-based system using points, levels, leaderboards, achievements, and badges. Students created avatars, and a leaderboard tracked the progress of their avatars up the mountain. Tasks with unknown rewards were given to students; students only learned what the reward was (if any) after the due date for the task, much like a slot machine gives out random awards.

During this part of the class, the leaderboards showed a disturbing trend: while a few of the students were highly motivated and competitive, most of the students stopped doing any optional assignments after a few weeks. The chart below shows the progress of the students over the first six weeks where each student is represented by a single line (Nicholson, 2013). The number of lines that flatten out between week 4 and 6 indicate the number of students who did nothing for the class during those weeks.
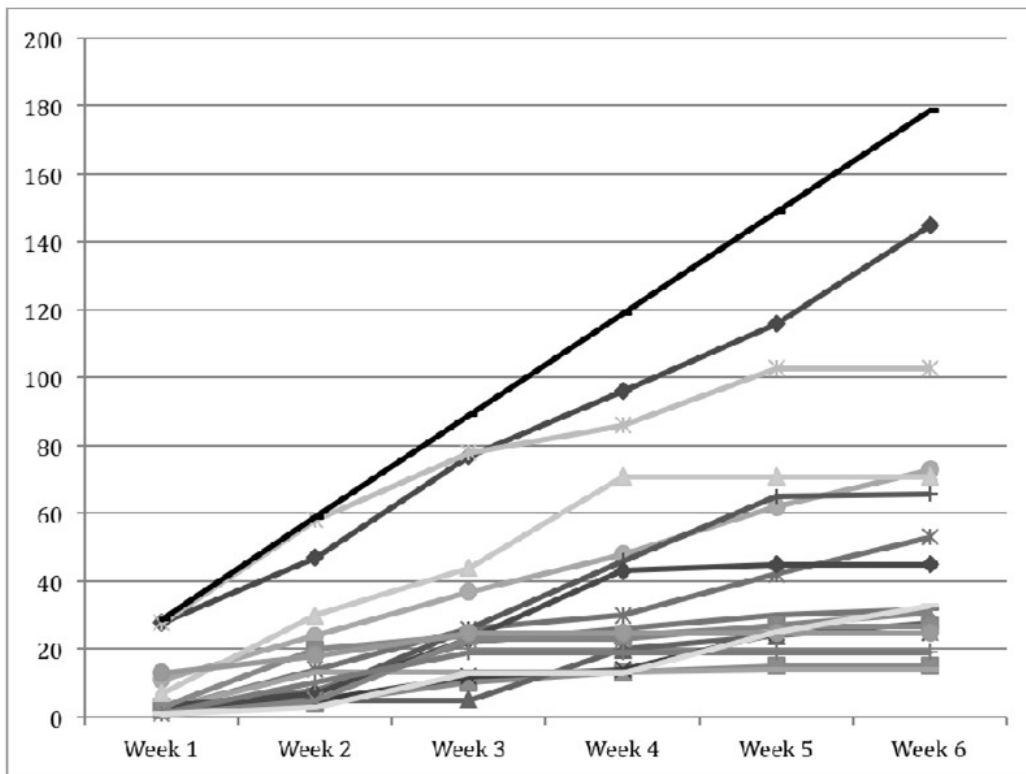
Figure 2. Grades of students over the first 6 weeks of class (Nicholson, 2013)

At this point, students were given a choice. The instructor appeared by candlelight, and in a video inspired by *The Matrix*, asked the students if they wanted to keep going or "come down the rabbit hole" and start a new voyage that they would help create. All but one student (the top performer) voted to start the voyage over. Students were also given an open-ended survey and allowed to reflect about their experiences, and many students indicated the de-motivating effect of the leaderboard. As the few high-performing students earned more points, the low-performing students did not see any reason to continue and were planning to drop the class.

Students were greeted with a blank syllabus, put into groups of three, and had three weeks to develop a new narrative, set of assignments, and method of assessment for the last month of the class. The class would then vote on which syllabus to use and the class would finish out with that syllabus. During this time, the tone of the readings also changed. The class moved into reading McGonigal's *Reality is Broken* and Kohn's *Punished by Rewards*, while exploring the concepts of meaningful gamification.

The winning narrative put the class in the position of lab rats, with the evil Dr. Nicholson running experiments on them. The Quest for Mount Gamification was nothing more than a mental simulation designed to stress the rats, and they had decided to form into rat packs to make an escape. To help with the narrative, Nicholson donned a lab coat and created weekly videos in his role as a mad scientist with the camera placed in a maze to support the narrative created by the students.

One challenge for the students was how to balance the work that students did (or did not do) with the remainder of the class. The solution was to have each student negotiate an assignment plan with the instructor. Students would identify the grade that they wanted, what they had done so far, and what they would do to earn that grade from a long list of possible assignments (or making up their own assignment).

The class finished out on a very positive note, as each student was in control of his or her learning. Every student except for one completed every assignment described on the learning agreements, some of

which required a major paper or project each week of the semester. The class experience was truly transformative for these students, as they got to experience the differential effects of reward-based versus meaningful gamification firsthand.

The key lesson from this experience is the power giving the learners control. As suggested by Self-Determination Theory (Deci & Ryan, 2002), autonomy is a strong motivator for students. In the semesters since this class, Nicholson has continued to use this method of allowing students to create their own syllabus, and each time, the class ends up with a different assignment and motivational structure. This creates a more playful classroom and students are more inspired to complete assignments that they had a hand in creating for themselves.

Case Study Two: Digital Game-Based Learning (Written by Katrin Becker)
Digital Game Based Learning taught by Katrin Becker was offered on two separate occasions, once as a two-week intensive face-to-face (F2F) class, and once as an online full semester (14-week) course.

The course was a graduate level course in digital game-based learning for a cohort of course-based Master of Education students at the University of Calgary, all of whom were completing their studies primarily by distance. Almost all of the students were professional educators working full-time. Most were classroom teachers, but there were also administrators from both the school and district board level. Part of the course requirements for the degree was the completion of a number of face-to-face courses offered in a compressed format over the summer, which is why one iteration of the course was a three-credit course that ran for two weeks and met daily for three hours, with an additional week after classes to complete and submit coursework. The second iteration of the course was completed entirely online in a regular semester.

Initially, the gamification of a section of the course assessment was meant to be a "throwaway" piece. The gamification component was added at the last minute to demonstrate a hands-on example of gamification, which was part of the syllabus and comprised 20% of the overall course grade. As the course progressed, the topic of gamification, as well as the details of how the course itself was gamified, became a focus and a touchstone to which the class returned again and again. In the second iteration of the course, the gamified component was increased to 50% of the overall grade. Most of the increased weight came from moving grades normally awarded for peer assessments into the gamified portion of the course.

Typically courses of this sort include required readings and reflections that often also include requirements to post on blogs and comment on each other's work. There is one or more major assignment and a final paper. The gamification portion of this course was implemented primarily in the management and assessment of student work. The instructor provided an assortment of readings and response activities for which students could earn points. They included blog posts, but also longer editorials and shorter annotations, among other things. An accumulation of points related directly to percentage points toward an overall course mark (10 XP = 1%), and they were given minimum and upper limits on how many tasks of each kind they could submit for points. Each kind of task had to be attempted at least once, but the upper limits were such that if they submitted the maximum possible number of items in each category, they could earn more than the number of points required for a perfect score. Any "extra" points earned could be applied to the course grade as a whole, which meant that students could make up for less than perfect scores in one part (such as their design project) by completing and submitting more work in another (such as providing additional annotated resources to share with the class).

The instructor created individual scorecards made from spreadsheets (one for each student) to keep track of everyone's points. Existing course management systems do not support this kind of scoring so points and grades needed to be tallied elsewhere.

On the whole, the students liked the approach, but found there to be a substantial learning curve due to the complexity that resulted from the increased choice of both the number and variety of learning tasks as well as the more complicated scoring scheme. The second iteration of the course went far more smoothly in spite of the fact that the scoring was in fact more complex. A number of students reported that this was

the best course they had ever taken, and that they had learned more in this course than in any other. On the other hand, the marking load was extreme, so some combination of automatic and personal scoring and assessment would have been useful.

A leaderboard was posted, but it consisted only of scores sorted in numerical order, which were not associated with individual names. Although students were encouraged to create avatars, only one or two did. Given that this was a graduate level class, a minimal pass was 70%, which was also necessary on each individual component.The work they had to do consisted of two major projects as well as the gamified activities. The gamified activities were referred to collectively as "The DGBL Game"). As is shown in Figure 3, not only did all students meet the minimum requirements, but 75% of them earned more than a perfect score.

rank	week											final
	3	4	5	6	7	8	9	10	11	12	final
1	85	185	250	260	430	430	555	555	555	650	650
2	55	80	120	235	390	390	450	450	500	599	649
3	50	75	120	220	315	335	415	450	476	594	594
4	45	70	120	190	310	310	390	439	439	590	590
5	30	65	100	120	244	279	345	374	410	576	582
6	20	45	95	100	205	220	344	345	399	534	576
7	10	40	85	95	180	215	260	290	320	511	534
8	10	30	70	85	151	151	215	266	297	442	529
9	10	10	22	50	129	129	171	260	291	435	526
10	10	10	10	29	79	96	96	235	285	386	491
11	10	10	10	22	50	70	87	180	260	349	445
12	10	10	10	10	49	65	70	111	111	310	433
13	10	10	10	10	25	49	65	65	65	160	380

Figure 3. Leaderboard for EDER 679.17, 2013

This phenomenon is not unique to gamification. Becker has been using a bonus point system in her classes since 1999 where students could earn points over and above those required for a perfect score on an assignment by adding various embellishments to their submissions. These "extra" points could then be used to bump a student's grade up a portion of a letter grade. In other words, a student who had earned a B in the course could increase that to a B+ if they had sufficient bonus points (Becker, 2003, 2006). It is interesting to note that those students who earned the highest bonus scores had also earned high scores on all other components of the course. In most cases, the extra points had no effect on the students' score. In other words the extra work was not reflected in their grades, and they knew this but did the extra work anyway.

Case Study Three: Beyond the Multiplayer Classroom: A Story (Written by Lee Sheldon)
When I first began designing my classes as real world, real-time multiplayer games it was enough to translate the various elements of game mechanics into teaching and learning. These including grading by attrition (XP and leveling up); learning by failing (allowing students to redo assignments); intrinsic rewards (such as dividing students into guilds and rewarding an entire guild for the achievement of one member); peer teaching and so on.

For several years I experimented and honed the basic building blocks of the design. I was content to emulate the sandbox style of game design of current MMOs, concentrating on gameplay rather than story. There was no clear reason not to. Grades and attendance already benefited tremendously from the multiplayer classes over traditional teaching methods. Indeed today *The Multiplayer Classroom* is used by hundreds of others to teach everything from Biology to Latin Prose Composition to the Holocaust.

It was not until I taught a course called "Designing Interactive Characters for Digital Games" that I decided to add a continuing role-playing game with NPC characters that the students interacted with and a single ongoing story to provide a structure for the entire class. I was in the middle of this class when my book, *The Multiplayer Classroom: Designing Coursework as a Game*, was published.

That first excursion into the type of storytelling I routinely used in commercial video games was only partly successful. The students were co-creators of the ongoing story and they also played characters within it. We reached a critical point in the story where the students had to decide whether an NPC they had traveled with for weeks on the long road of the quest should be allowed to live or die. When I asked the question we were all confused: should they answer in character or as game designers This speed bump led to an enlightening philosophical discussion of the roles of designer and player.

But other parts of the experience were so gripping that the students were far more focused than in my earlier classes: they leveled and learned. On the last day of each class I hold a post mortem, allowing students to comment on what went well and giving ideas on what could be improved. Two items stood out here: a midterm exam prep (outside the scope of this short story) and narrative. The ongoing story involved them to a much higher degree—and therefore ratcheted up their learning—than the sandbox games of the past. While activities in the classroom can be powerful, changing the stage upon which the students explore topics can add a new layer to gamification of the classroom.

Upon my arrival at Rensselaer Polytechnic Institute, two colleagues and I were awarded a seed grant to develop what I called the Emergent Reality Lab, a 3D virtual reality space. The first project destined for that lab was to be teaching Mandarin and Chinese culture. Due to a variety of circumstances the lab took much longer to realize than initially planned. So, with the help of a huge number of people from across the campus and beyond, I designed an eight-week dress rehearsal for the kind of teaching to be carried out in the lab. Twelve students were selected from over fifty applicants. One dropped out almost immediately, so we had a class of eleven divided into four study groups. None had had any previous experience with Chinese, although several had taken other languages in traditional classes.

While there were many game-like puzzles and we occasionally used Microsoft's Kinect to solve some, from the very beginning storytelling was transcendent, involving live actors in the physical world. The game was called *The Lost Manuscript*. Without leaving the classroom the students were transported to locations in Beijing including Capital International Airport, a tearoom and the Forbidden City. They were immersed in a story involving several characters (portrayed by native Mandarin speakers) hunting for the priceless manuscript to a classic work of Chinese literature, *Outlaws of the Marsh*.

In only their fourth week they were to arrive at Beijing International Airport, clear customs, exchange currency, acquire maps to the city, use a virtual kiosk manipulated with the Kinect to locate their hotel, call the hotel, order transportation, then recognize the traditional Chinese characters for Public Transportation on one of many signs scattered about the "airport" and stand beneath it. This was done as a live action activity with sets and actors. The actors were instructed to only speak Mandarin. The students had the entire class period, an hour and fifty minutes, to do everything.

The week before, as they were practicing the vocabulary and syntax to perform these tasks, they were told by their teacher (also our Instructional Designer as well as a fictional character) that they need not worry. They would be met in Beijing by a Dr. Chen who would guide them through what they needed to accomplish. But when they arrived they found only a crumpled sign on the floor that read, "Welcome Rensselaer Students." No sign of help at all. Or so it would appear.

They immediately began to help one another. They were so successful they completed all the challenges I had designed in thirty minutes. Then, instead of taking off, they continued to play. In halting Mandarin and with the aid of an English/Chinese dictionary they spent the remainder of the class time questioning the actors if they had seen Dr. Chen or knew anything about him. In game design we describe this as emergent behavior. They went beyond what I had designed because they a) did not know where the edges of the design were, and b) they wanted to know what would happen next. They learned more than intended, almost without realizing it, a state I call *collateral learning*.

Any competent storyteller knows that unexpected twists to the plot are always useful to heighten suspense and engagement. Another twist I incorporated into *The Lost Manuscript* began with a series of text messages from each of the game's five main characters. At first each of these were sent to all eleven students. But in the fifth week—when the students were fully engaged in the mystery—the messages changed. Each character began sending messages only to one study group. Among other things the students in each study group were told not to trust the characters texting the other groups. This created suspicion between the study groups. They had to decide whether to exchange information or compete to be the first group to unravel the clues to the manuscript's location. They began collaborating, became competitive, only to settle again on collaboration in the end. This tension increased their focus and learning even more.

Their final exam was a police interrogation. They all passed. According to our instructional designer they learned a fifteen-week semester's worth of Mandarin in eight weeks.

There are many examples in the literature on the benefits of using storytelling to teach. More recently, scholarly study has centered on using games to teach. There has been next to nothing about combining multiplayer gameplay and an ongoing story, although all of my current projects—whether multiplayer classrooms or video games or online games—are now a balance of the two. In addition to *The Lost Manuscript 2*, currently being developed for the lab, we are creating games to teach math, statistics, culture, business ethics, and engineering.

The prototype for the engineering game video game is complete. It is called *These Far Hills*, the story of an extended Irish family that immigrates to a new land in the nineteenth century. However, the new land this family journeys to is Mars where they will build a biosphere for other families to follow. A single-player game, students will play a 45-year-old mother of four mentored by the NPC leader of the project, her father. That powerful emotional hook already promises to heighten players' connection to the story and the learning. Infused with Irish music, conflict, comedy and drama, *These Far Hills* is interwoven with the highest pedagogy.

Currently the first online *Multiplayer Classroom* is taking shape for Excelsior College. It features another design idea I am interested in exploring: which is that two of the students in the class are not real. This is easy in an online game. They will function as the game's hint system, drive discussion, and finally be revealed as characters in the story of the class concerning two opposing factions struggling for control of the Internet. It will be another step on my own journey to explore how the most ancient of human experiences, gameplay and storytelling, can be used in brick and mortar classrooms and online to recapture, captivate and teach students of all ages.

Best Practices

Providing authentic, meaningful learning is at the core of all good instruction, gamified or not (Merrill, 2002). Gamification can manipulate students into taking on tasks, but it can also motivate them to engage more deeply with course material. Adding gamification to a class adds a significant amount of instructor workload overhead, and instructors need to decide whether their time is better spent developing a mechanics-heavy gamification system for class management or creating more engaging game-based learning activities within a traditional structure.

Some of the best practices drawn from research and examples discussed in this chapter include:
1. **Setting clear goals.** Gamification can add many different approaches to course content, learning tasks, and the assessment of students, but without clear goals, students can spend considerable time on side topics or elements that do not help them earn the desired grade while missing the key course content. This can be a concern in classes that lead to a standardized test or classes that are prerequisites for other classes. Setting goals for the students or negotiating the goals with the students allows them to understand what they are trying to accomplish throughout the class, and while this is important in all classes, it is especially important in a gamified class.
2. **Providing administrative support.** Most students are used to one specific grade-based game in classes. There may be slight differences between instructors, but the basic concept of grading on

an A-F scale is the same. On the other hand, some gamification systems are fundamentally different from the grading system, and these differences can frustrate students who are not gamers and who do not have the experience in taking on different rule systems. Instructors should have regular reality checks with the students to ensure they understand what is really going on and what is necessary for the students to do to reach certain grades in the class.

3. **Providing additional feedback.** A benefit to students in most gamified systems that allow students to re-do work is that such a system requires the instructor to provide detailed feedback so that the student can re-do the work. In addition, this feedback must be provided quickly so that students can re-work the assignment before the next assignment is due. If this cycle breaks, the student can be frustrated as he or she is trying to re-do several older assignments while keeping up with new assignments. Instructors need to be willing to take on the additional challenge of providing timely feedback to help a gamified classroom to succeed.

4. **Using a student-created narrative.** Allowing the students to create all or some of the narrative for a gamified system engages the students and encourages them to think deeply about the topic of the class and the real-world applications of the topic. Moreover, it helps them to understand why what they are learning matters, and empowers them to engage more deeply with the activities throughout the semester.

5. **Many of the elements of gamification have already been done in classrooms.** Instructors seek ways to engage students, and the language of game design provides many ways to increase engagement. The benefit of grouping pedagogical concepts together under the gamification umbrella is that it draws the attention of others constituents, such as those developing learning management systems. The result is that an instructor wanting to add game design elements to the classroom does not have to start from scratch; instead, there is now a growing body of tools and resources that makes this process easier for an already overloaded instructor.

Resources

Related Researchers
Sebastian Deterding
Karl Kapp
Lee Sheldon
Scott Nicholson
Barry Fishman
Clayton Ewing
Katrin Becker
Gabe Zicherman
Ian Bogost
Jane McGonigal
Kevin Werbach

Books, Reports, & Papers

Alberti, J. (2008). The game of reading and writing: How video games reframe our understanding of literacy. *Computers & Composition, 25*(3), 258-269.

Ely, M. (2011). 3 Reasons NOT to gamify education. *LearnBoost.*. Retrieved from https://www.learnboost.com/blog/blog/3-reasons-not-to-gamify-education/.

Heick, T. (2011). The gamification of education: What school can learn from video games. *Edutopia.org.* Retrieved from http://www.edutopia.org/blog/gamification-education-terrell-heick.

Juul, J. (2011). Gamification backlash roundup. *The Ludologist.* Retrieved from http://www.jesperjuul.net/ludologist/gamification-backlash-roundup.

Kapp, K. M. (2012). *The gamification of learning and instruction : game-based methods and strategies for training and education.* San Francisco, CA: Pfeiffer.

Kohn, A. (1999). *Punished by Rewards: The Trouble with Gold Stars, Incentive Plans, A's, Praise, and Other Bribes* Boston, MA: Houghton Mifflin.

Sheldon, L. (2012). *The multiplayer classroom: designing coursework as a game.* Boston, Mass.: Course Technology/Cengage Learning.

Valdes, G. (2012). Three things you need to know about gamification. *VentureBeat.* Retrieved from http://venturebeat.com/2012/07/03/three-things-about-gamification/.

Ventrice, T. (2011). Gamification: Framing the discussion. *Gamasutra*. Retrieved from
    http://www.gamasutra.com/view/feature/6530/gamification_framing_the_.php.

Videos

3D Game Lab (http://3dgamelab.com/)
Academy LMS (http://www.growthengineering.co.uk/category/learning-management-system/)
Andersen, P. (2012, Apr 24, 2012). Classroom game design TEDx bozeman. YouTube Video retrieved from
    http://www.youtube.com/watch?v=4qlYGX0H6Ec.
Deterding, S. (2012, 12 October 2012). 9.5 Theses on the power and efficacy of gamification. *Microsoft Research.*
    http://research.microsoft.com/apps/video/dl.aspx?id=174677&l=i (note: this talk is 1h23m long but it covers a
    LOT of ground and is well worth the time)
Deterding, S. (Producer). (2010, Jan. 2012). Pawned. Gamification and Its Discontents. SlideShare presentaion
    retrieved from http://www.slideshare.net/dings/pawned-gamification-and-its-discontents.
Extra Credits. (2012, May 13). Extra Credits: Gamifying Education. YouTube video retrieved from
    http://www.youtube.com/watch?v=MuDLw1zIc94
Gamified Learning Management Systems
Gradecraft (https://www.gradecraft.com/)
McGonigal, J. (2010, Mar 17). Gaming can make a better world TEDTalks.YouTube video retrieved from
    http://www.youtube.com/watch?v=dE1DuBesGYM
Nicholson, S. (2012, Dec. 25, 2012). A RECIPE for Meaningful Gamification. YouTube video retrieved from
    http://www.youtube.com/watch?v=f4qikCx_SSc
Patel, S. (2011, Dec 5, 2011). How Game Mechanics can Change Education TEDxChandler. YouTube video
    retrieved from http://youtu.be/E97HHr6M6RU
Queso (http://conque.so/)

References

Becker, K. (2003). Assignments that meet the needs of exceptional students without disadvantaging the average.
    Paper presented at the 8th annual conference on *Innovation and Technology in Computer Science
    education*, Thessaloniki, Greece.
Becker, K. (2004). Reconciling a traditional syllabus with an inquiry-based introductory course. *The Journal of
    Computing Science in Colleges*, 20(2), 28-37.
Becker, K. (2006). How much choice is too much? *SIGCSE Bull.*, 38(4), 78-82. doi: 10.1145/1189136.1189176.
Becker, K. (2012) The decorative media trap. *CNIE Green Aware 2012 – The Canadian Network for Innovation in
    Education*, 14 - 16 May 2012, Canmore, Alberta
Becker, K & P. Perri (2013). Is gamification a game-changer? Comparing gamified and non-gamified approaches
    presented at: *Mount Royal University Centennial Symposium on Scholarship of Teaching and Learning*
    Banff, Alberta, November 7 - 9, 2013
Becker, K. (2013) Gamification: How to Gamify Learning and Instruction, Master Class presented for ACCP-CAID,
    Canadian Association of Instructional Designers, online, November 13, 2013
Bogost, I. (2012). Persuasive Games: Exploitationware. *Gamasutra*. Retrieved from
    http://www.gamasutra.com/view/feature/6366/persuasive_games_exploitationware.php
Charles, D., Charles, T., McNeill, M., Bustard, D., & Black, M. (2011). Game-based feedback for educational multi-
    user virtual environments. *British Journal of Educational Technology*, 42(4), 638-654.
Crawford, D. (2004). Forum: No scientific discipline was ever built on a myth. *Communications of the ACM, 47*(9), 11-
    13.
Deakin-Crick, R., Sebba, J., Harlen, W., Guoxing, Y., & Lawson, H. (2005). Systematic review of research evidence
    of the impact on students of self- and peer-assessment. Protocol Research Evidence in Education Library
    (pp. 1-22). London: EPPI-Centre, Social Science Research Unit, Institute of Education, University of London.
    Deci, E. and Ryan, R. (2002). Overview of self-determination theory. *Handbook of Self-Determination
    Research*. Rochester, NY: University of Rochester Press, 3-33
Dewey, J. (1916). Democracy and Education: an introduction to the philosophy of education. New York: MacMillan.
Deterding, S., Dixon, D., Khaled, R., & Nacke, L. (2011). From game design elements to gamefulness: defining
    "gamification". *Proceedings of the 15th International Academic MindTrek Conference: Envisioning Future
    Media Environments*, Tampere, Finland
Deterding, S. (2012). 9.5 theses on the power and efficacy of gamification. *Microsoft Research*. [Microsoft Research
    Video] Retrieved from http://research.microsoft.com/apps/video/dl.aspx?id=174677&l=i on 12 October 2012.
Digital Media and Learning Competition (2011). *Digital Media + Learning Competition 4: Badges for Lifelong
    Learning*. Retrieved from http://dml4.dmlcompetition.net/.
Holman, C., Fishman, B, & Aguilar, S. (2013). Designing a game-inspired learning management system. Presentation

at *Games + Learning + Society 9.0*, Madison, WI.

Kapp, K. M. (2012). The Gamification of Learning And Instruction: Game-Based Methods and Strategies for Training and Education. San Francisco, CA: Pfeiffer.

Kohn, A. (1999). Punished by Rewards: The Trouble with Gold Stars, Incentive Plans, A's, Praise, and Other Bribes. Boston: Houghton Mifflin.

Kohn, A. (1992). *No Contest : The Case Against Competition* (Rev. ed.). Boston: Houghton Mifflin.

Kumar, Janaki Mythily and Herger, Mario (2013). *Gamification at Work: Designing Engaging Business Software.* Aarhus, Denmark: The Interaction Design Foundation. Book available online at http://www.interaction-design.org/books/gamification_at_work.html

Mezirow, J. (1991). *Transformative Dimensions of Adult Learning.* San Francisco, CA: Josey-Bass.

Merrill, M. D. (2002). First principles of instruction. *Educational Technology Research and Development : ETR & D,* 50(3), 43-60.

Mozilla. (2013). *Mozilla OpenBadges: About.* Available online at http://openbadges.org/about/.

Nicholson, S. (2012a, June). A user-centered theoretical framework for meaningful gamification. Paper Presented at *Games+Learning+Society 8.0*, Madison, WI. Available online at http://scottnicholson.com/pubs/meaningfulframework.pdf

Nicholson, S. (2012b). Completing the experience: Debriefing in experiential educational games. In the *Proceedings of the 3rd International Conference on Society and Information Technologies.* Winter Garden, Florida: International Institute of Informatics and Systemics. 117-121.

Nicholson, S. (2013, June). Exploring Gamification Techniques for Classroom Management. Paper Presented at G*ames+Learning+Society 9.0,* Madison, WI. Available online at http://scottnicholson.com/pubs/gamificationtechniquesclassroom.pdf

Renaud, C., & Wagoner, B. (2011). The gamification of learning. *Principal Leadership*, 12(1), 57-59.

Robertson, M. (2010). *Can't play, won't play (Hide & Seek, Inventing New Ways to Play).* Blog Retrieved from http://hideandseek.net/2010/10/06/cant-play-wont-play/ on May 24 2013.

Rose, D. & Meyer, A. (2002). Teaching Every Student in the Digital Age: Universal Design for Learning. Alexandria, VA: ASCD.

Shaw, A. (2008). What is 21st Century Education? Retrieved from http://www.21stcenturyschools.com/what_is_21st_century_education.htm on Mar. 2, 2015.

Sheldon, L. (2012). *The Multiplayer Classroom : Designing Coursework as a Game.* Boston, Mass.: Course Technology/Cengage Learning.

Werbach, K. (2012). *Course announcement.* In Coursera Gamification Course Registrants (Ed.) https://www.coursera.org/course/gamification

Wiggins, G. P., & McTighe, J. (1998). *Understanding by design.* Alexandria, Va.: Association for Supervision and Curriculum Development.

Zichermann, G. & Cunningham, C. (2011). Gamification by Design: Implementing Game Mechanics in Web and Mobile Apps. Sebastopol, CA: O'Reilly Media.