Gamification

James Willig
Erin Snyder
• Gamification: application of game dynamics, mechanics and frameworks into non-game settings

• Underlying dynamics that make game engaging are largely already recognized and utilized in modern pedagogical practices – although under different designations
  – Reducing the complexity of well designed games to their surface elements (i.e. badges and experience points) falls short of engaging students and can actually damage existing interest and engagement
• Underlying dynamics/concepts game design shown to be more consistently successful than others when applied to learning environments
  – Freedom to fail
  – Rapid feedback
  – Progression
  – Storytelling
Freedom to Fail

• Game design often encourages experimentation without fear of causing irreversible damage
  – Multiple lives, restart from nearby “checkpoint”

• If students encouraged to take risks and experiment; focus taken away from final results and re-centered on process of learning
  – Modern pedagogy recognizes this; increased use of formative assessment which focuses on the process of learning rather than end result by using assessment to inform subsequent lessons and separating assessment from grades whenever possible
  – Teacher uses ongoing assessment to inform teaching or illustrate a point eschewing concrete grades much of the time
Freedom to Fail

• Encourage learners to explore content, take chances with decision making and be exposed to realistic consequences for making a wrong or poor decision
  – Incorporate student assessment that highlights useful lessons taught through the experience while subduing indelible marks or grades
  – Maintain a positive relationship with failure by making feedback cycles rapid and keeping the stakes low
Rapid Feedback

• Feedback is a critical element in learning
  – The more frequent and targeted, the more effective the learning
  – Game design: feedback given moment by moment, often summarized at the end of a level/after boss battle
  – Educators can increase feedback by harnessing elements of game design through “continual feedback to learners in the form of self-paced exercises, visual cues, frequent question-and-answer activities, a progress bar, etc.”
Progression

• Game design: evidence as missions or levels

• Modern Pedagogy recognized as scaffolded instruction
  – Scaffolded learning: framing, guiding and supporting students by organizing information into categories to focus attention
  – Helps avoid the “I don’t know how to get started” problem and allows student to restart if he or she gets stopped or stumped (links with freedom to fail dynamic)
Progression based on success at earlier levels providing building blocks for facing tougher challenges

<table>
<thead>
<tr>
<th></th>
<th>Remembering: Can student recall or remember the information?</th>
<th>Understanding: Can the student explain ideas or concepts?</th>
<th>Applying: Can student use information in a new way?</th>
<th>Analyzing: Can student distinguish between the different parts?</th>
<th>Evaluating: Can student justify a stand or decision?</th>
<th>Creating: Can student create new product or point of view?</th>
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<tbody>
<tr>
<td></td>
<td>Define, duplicate, list, memorize, recall, repeat, reproduce, state</td>
<td>Classify, describe, discuss, explain, identify, locate, recognize, report, select, translate, paraphrase</td>
<td>Choose, demonstrate, dramatize, employ, illustrate, interpret, operate, schedule, sketch, solve, use, write</td>
<td>Appraise, compare, contrast, criticize, differentiate, discriminate, distinguish, examine, experiment, question, test</td>
<td>Appraise, argue, defend, judge, select, support, value, evaluate</td>
<td>Assemble, construct, create, design, develop, formulate, write</td>
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Progression

• Progression can also be linked to game dynamics as
  – **Interest curve**: By purposefully sequencing events in a particular order engagement is increased (ex: public speaking grab audience with highly interesting element initially and strategically throughout) – high and low points create a sequence known as the interest curve

  – **Just in time teaching**: process of gathering assessment immediately prior to a lesson so as to tailor lesson to specific student needs at that time. By consistently touching on points that are most relevant to audience to audience at the time of the lesson, engagement increased and students better equipped with tools to succeed
Storytelling

• Most games tell some sort of story
  – Monopoly: becoming rich through property ownership at the risk of losing it all
  – People learn facts better when they are embedded in a story rather than in a bulleted list (read about your patients...availability bias)
  – Providing a unifying story throughout a curriculum can put learning elements into a realistic context in which actions/tasks can be practiced – extremely effective in increasing student engagement and motivation
User centered theoretical framework for “Meaningful Gamification”

• Gamification: Use of game design elements in non-game context

• Frequent model: Accrue points → Threshold → Reward
  – Wrong if: Replaces internal motivation with external motivation
  – Right if: Game design elements meaningful, improve internal motivation

• “Meaningful gamification” strategies
  – Organismic integration theory
  – Situational relevance
  – Situated motivational affordance
  – Universal design for learning
  – Player-generated content

Nicholson S., School of Information Studies, Syracuse University, becauseplaymatters.com
Gamification

• Common implementation
  – Take scoring elements of video games (points, levels, achievements) apply them to work or educational context
  – Game: A form of play with goals and structure

• Term is new, but been around a while in loyalty systems
  – Frequent flyer miles, green stamps, summer reading programs
  – Pointsification: gamification system that adds only scoring system to a non-game activity. Focuses on goals not play “exploitationware”
Organismic integration theory (OIT)

• Sub-theory of self-determination theory which focuses on what drives individuals to make choices without external influence

• External rewards unrelated to activity least likely to be integrated (perception is that someone else is controlling individual’s behavior)

• Allowing users to self-identify with goals or groups that are meaningful much more likely to produce autonomous, internalized behaviors, user connects goals to other values they hold

• A user who has fully integrated the activity along with personal goals more likely to see as positive vs. if external control integrated with activity
Universal Design for Learning (UDL)

• UDL (from Education): courses should be designed so that students can demonstrate learning in a variety of ways

• Allow students to select the way in which to demonstrate how they have met learning outcomes – not all exams/presentations
  – Course meaningful to a wider variety of learners

• Combine
  – Different ways to present content (what)
  – Provide different activities to explore and demonstrate mastery of content (how)
  – Provide different paths to internalize content and become engaged/motivated (why)

• In Gamification:
  – Allow users to demonstrate mastery/achieve in several ways (select most meaningful to them) or allow users to set their own goals and achievements
Player-Generated Content

• Engage users in creating and sharing, allowing player developed content to extend the life of a game/set own goals

• In educational contexts where learning goals must be met
  – Place constraints on users choices to guide them toward those that are both meaningful to the user and meet organization’s needs
  – Transparency will allow learning why constraints in place, learning outcomes and to see connection of game elements to outcomes

• For meaningful gamification, allow communities of learners to share experiences, content and ideas on how to increase fun without an external reward
User-Centered Design

• Theory of user-centered design ensures that user needs and goals are the primary consideration at every stage.

• *Meaningful gamification* is the integration of user-centered game design elements into non-game contexts.

• Using external rewards is not user centered, rather design elements meaningful to users to effect change in their mindset – ask at every gamification design decision, “how does this benefit the user?”

• At the heart of “meaningless gamification” is organization centered design.
  – Relies on external rewards focused on organization’s bottom line, not user benefits.

• There are no cookie cutter approaches to meaningful gamification.
Examples of meaningful gamification
Camry Hybrid Display

- Display shows driver whether power coming from fuel or battery
- Information enables driver to create their own games and goals (much better than providing a “green score” alone)
“This site is dedicated to the thought that something as simple as fun is the easiest way to change people’s behavior for the better. Be it for yourself, for the environment, or for something entirely different, the only thing that matters is that it’s change for the better”.

Swedish subway to encourage folks to use stairs...

Focus on aspects of underlying activity to determine where adding game elements makes sense.
In summary

• Meaningful gamification puts needs/goals of users over the needs of the organization

• If users have a positive and meaningful game experience that is well connected to the underlying non-game setting, then the organization will benefit in the long term.
  – Adds element of play rather than scoring
  – Designers provide variety of game-based activities to appeal to different users or customizable tools so user can create their own activities
  – Dependence upon external rewards for motivation should be replaced by connections between the non-game activity and needs/goals in users’ life which will allow users to have a positive internalized experience
  – User-centered meaningful gamification will result in longer-term and deeper engagement between participants, non-game activities and supporting organizations


Phylo: Multiple Sequence Alignment

• Multiple sequence alignment
  – Arranging sequences DNA, RNA or protein to identify similar regions among different species
  – Via recognition alignments, biologists may infer shared evolutionary origins, identify functionally important sites, mutation events, trace source of genetic diseases

• Traditionally
  – Computationally complex heuristics align sequences, but approach does not guarantee global optimization, $$$, bigger = more complex
  – Humans solve visual problems efficiently, make sequence data into colored shapes, humans have a go
  – Optimizations stored
None of us is smarter than all of us.....

Crowdsourcing malaria parasite quantification

• Estimated 600,000 new malaria cases daily worldwide
  – Counting parasites in blood smears through a microscope is the gold standard estimating parasite burden
  – Takes 20 minutes of an expert microscopist’s time

• Web-based game
  – Volunteers detected parasites in digitized blood images
  – Tagged as many parasites as possible in 1 minute
  – Decision algorithm combined analyses from several players to produce an improved collective detection outcome
Crowdsourcing malaria parasite quantification

• In one month
  – Anonymous players from 95 countries played more than 12,000 games and generated a database of more than 270,000 clicks on test images

• Results
  – Combining 22 games from non-expert players achieved a parasite counting accuracy higher than 99%
  – Same performance could be obtained by combining 13 games from players trained for 1 minute
What can we crowdsourc in regards to education?