Gamification and simulations & games for STEM ed

Resources for the 28 August 2013 Spark tagup:

We'll look at three closely related topics - gamification, use of games in STEM ed, and use of simulations in STEM ed.

Gamification

Definition - **Gamification**: applying game-like techniques to teaching. Does **not** necessarily imply use of games in a curriculum. Typically employs ideas like experience points, quests, leveling up, and badges in an educational setting. Examples:

- you must complete the "Clouds" quest before you move on to the "Hurricanes" quest. There are 7 choices for clouds badges; you must get at least 4 of them to complete the quest (or could be "you must earn 1,000 experience points doing cloud activities of your choice to complete the clouds quest")
- has elements of the merit badge system in Boy Scouts - you must earn 21 merit badges to become an Eagle Scout - some are required (Camping, First Aid,...) but many are the scout's choice (Astronomy or Reptile Study or Basket Weaving)
- has elements of games like Dungeons and Dragons and many computer games - earn experience points, level up to get new abilities, unlock quests, etc. - but there are many paths by which one could earn those experience points
- fun and student choice and mastery learning are emphasized

Watch these 2 short videos and read the 2-page whitepaper to get a sense:

- 3D GameLab from Student Perspective - 3D Gamelab is a web-based platform for helping teachers "gamify" their classes - under development by Chris Haskell and colleagues at Boise State University (3.5 minute video)
- 3D GameLab: Turn Class into a Game! - promo video for 3D Gamelab (1 minute video)
- 7 Things You Should Know About Gamification (2 page whitepaper from Educause)

Use of Games and Simulations in STEM Ed

- **Simulation**: spend a few minutes playing around with either PhET's **Greenhouse Effect simulation** or their **Glacier simulation**
- **Game:** play a couple of levels of **TERC's Impulse game**. If you can, have someone with you while you play; your dialog as the two of you try to figure the game out might be interesting to note.
- Consider: how are games and simulation different from each other?
- Watch this video of Jane McGonigal's TED Talk: "Gaming can make a better world"

Notes from Tag-up Discussion

On 28 Aug 2013 we had a tag up discussion lead by Randy regarding the topic of "gamification" and simulations and games related to STEM Ed. The group discussion based on reading, video viewing, and trying our had a few games as homework and interesting was lively.

Here are some of the main points we discussed:

- We discussed whether games are effective learning tools and the point was made the same discussion (and analysis) applies to other learning tools like books, calculators, rulers, etc! One should look at "What features?" and "How are they used?" Tim asked, "Do these really teach and having to pay attention to whether skills transfer from the game to real life."
- It was immediately asked if anyone had "Tech Issues" trying to do the homework, and some in fact did. This is an issue for using games to educate other populations as well and must be considered.
- In gamification approaches, "prerequisites" become "unlocking a new level", etc
- We spent some time discussing gender bias, gender issues, and different gender approaches and interest to gaming and games in education. While many show a male bias and may be made by or more for males, it is something we can be cognizant of in our involvement. The roles of both collaboration and competition in games appeal to different types of users and both probably should have a role in successful education application of games. It is more important to some users to understand the purpose of the game, while others are happy to just start clicking!
- We noted that many popular games and interactives do teach "system(s) thinking" which is very applicable to STEM Ed too.
- It was noted that commercial entities (like Vail) are using some of the eletronic/game based motivations of earning levels and badges to stimulate (and track) use of their facilities. The examples included "vertical feet gained", "number of runs", etc. **NOTE:** Many of us got excited talking about how this approach could be used to stimulate and extend visitors ML exhibit experience (earning badges for interacting with exhibits, biology outside, geo markers outside and GIS, learning about architecture, visiting science art gallery, interacting with parts of our website, participating in a balloon launch, etc. This is potentially both "low hanging fruit" AND a "big effort"! We agreed that concept needs to extend outwardly so that it doesn't only serve local visitors. We also think there is potential to tie an effort like this into NGSS.

- Might Ed grants and/or foundations be interested in funding us to do some of this work???* Wendy asked how people felt about the Jane McGonigal TED talk on leveraging gamers developed skills to solve real world problems and is this something that UCAR can tap in to. We think there is promise.
- We also discussed crowd sourcing, citizen science, and how it can be and is being used made a bit of a game out of sometimes tedious data entry and transcription tasks. People are helping science and earning digital badges! How might big data, supercomputing, and our geosciences take advantage of this?
- Several folks suggested that one way to reach more folks is try to go to the already popular games where kids are and find out if there is interest by the gaming companies to bring any elements of geoscience in to them (like survival in a changing climate, etc.) This might be a way to reach more people than creating our own games where users "sniff out" the fact they are educational games.
- We discussed to complete the experience that Teacher Guides could/should accompany games so they can extend the student's experience to the classroom.