

## Playing to learn game design skills in a game context

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**Abstract:** This interactive session presents early research findings resulting from a game simulation currently called *Gamestar Mechanic* through which 70 middle and high school-age players learn to *design* video games. *Gamestar Mechanic* is an RPG (Role-Playing Game) style online game through which players “take on” the behaviors characteristic of professional game designers (e.g., designing games, accounting for variability change within a game’s system, critiquing games). Reflecting on and practicing design can lead, we believe, to skills that are crucial for success in the modern, high-tech, global world. Game design is but a start in learning to think of complex interactions among variables, people, and technology, but it is also a domain that can help others reflect on complex interactions among systems. Early findings are showing that the pedagogical design of *Gamestar Mechanic* has the potential to help participants develop understanding of technical concepts particular to game design, systems-thinking skills, and other behaviors associated with the domain.

### Overview: *Gamestar Mechanic* and the emerging games and learning field

This session will be devoted to *GameStar Mechanic*, a video game whose core game mechanic involves designing games. It is an RPG (Role-Playing Game) style online game where middle and high school-age players learn the fundamentals of game design by playing roles as “game mechanics” charged with the making and “modding” (modifying) of games. The game is being developed and tested in a collaborative project between the game company Gamelab in New York (<http://www.gamelab.com/>) and the Games, Learning, and Society Program at the University of Wisconsin, Madison (<http://website.education.wisc.edu/gls/>). It is being funded through the MacArthur Foundation’s new Digital Media and Learning Initiative (<http://www.digitallearning.macfound.org/>). The project holds out a great deal of importance for educational reform, especially in the new push for innovation, creativity, and systems thinking (Friedman 2006). However, such a project may seem odd to people not familiar with current work on games and learning (Gee 2003, 2007) and its relation to design-based learning (Kolodner, 2002)

Some years ago, the New London Group (1996), in its manifesto on multiple literacies and new literacies argued that “design” ought to be seen as the center of learning for young people in the modern world. We live in a world in which complex systems interact in often dangerous ways. We humans intervene in the world by understanding natural systems as if they were designed so that we can leverage them for our own (good or bad) purposes. We also design complex systems that interact with designed and natural systems in complex ways. Policy decisions and civic participation in the modern world need to rely on “design thinking” that focuses on intra- and inter-system relationships and patterns, as well as the intended and unintended consequences of local actions within a complex system (witness the intersections of religion, culture, language, industry, economy, and politics in the Iraqi War and the disaster to which simplistic linear thinking has led). The New London Group stressed, as well, the importance of seeing language and literacy as systems that humans don’t just accept and passively use, but design in practice moment by moment through decisions and choices, hopefully based on deep understanding of the communicative resources (the “design grammar”) constituted by different styles of language.

*Gamestar Mechanic* is a game designed to teach young people about game design, with the emphasis on design, not programming. Game design inherently involves building, assessing, and transforming systems that involve game mechanics and human interactions with technology and other humans. The goal is not to entice young people into game design as a career, though the game will introduce them to aspects of what such a career would involve. The goal is to help young people—gamers and nongamers—learn what it is like to think about design and to think like a designer (Salen & Zimmerman, 2003). Game design is, for many young people today, a highly motivating domain within which to first think about design.

Game design involves a rich array of knowledge and skills. Knowing how to put together a successful game involves system-based thinking, iterative critical problem solving, art and aesthetics, writing and storytelling, interactive design, game logic and rules, and computer skills. The designer must also be a socio-technical engineer, thinking about how people will interact with the game and how the game will shape both individual, competitive, or collaborative social interaction.

Designers must use complex and technical linguistic and symbolic elements from a variety of domains, at a variety of different levels, and for a variety of different purposes. They must explicate and defend design ideas, describe design issues and player interactions at a meta-level, create and test hypotheses, and reflect on the impact of their games as a distinctive form of media in relation to other media. And each of these involves a melding of technological, social, communicational, and artistic concerns, in the framework of a form of scientific thinking in the broad sense of the term (e.g., hypothesis and theory testing, reflection and revision based on evidence, etc.). Learners are making and thinking about designed complex interactive systems, a characteristic activity in both the media and in science today.

One of our key goals for *GameStar Mechanic* is to intervene in the so-called “fourth-grade slump” and “eighth-grade cliff”, the phenomena whereby many children who pass early reading tests cannot read to learn as the complexity of language increases through the later grades. We believe that these phenomena are caused by young people’s lack of early preparation for and facility with “academic language”, the sorts of non-vernacular school-based language associated with the content areas in school (Gee, 2004). *GameStar Mechanic* is an ideal environment in which young people can learn and practice—in situated practices as part of a learning community—forms of specialist, technical, and academic language that pay off in school success.

Reflecting on and practicing design in these terms can lead, we believe, to skills that are crucial for success in the modern, high-tech, global world. We live in a world replete with interacting systems—natural and designed—that create complex risks, such as science, market, state, and demographic systems interacting to affect global environmental change. Game design is but a start in learning to think of complex interactions among variables, people, and technology, but it is also a domain where eventually, through “gamed simulations”, designers can help others reflect on issues of social change and complex interactions among systems.

At the same time, game and gaming are a truly global phenomenon. Young people all over the world—whether from rich or poor countries—play games if they have any access to them at all. People today are familiar with playing in multiplayer settings—like *World of Warcraft*—with people from all over the world. It is possible that we can use games, gaming, and game design as bridge with which to form international collaborations for world-wide creativity and innovation, as well as the spread of tech-savvy identities across the globe in the service of far more uniform development across countries and regions than we have today.

It should be mentioned here, as well, that games are a truly multicultural phenomenon in the United States. For example, African-Americans are among the largest demographic of game players and this holds true for many different game genres (<http://gotmaddgamez.blogspot.com/2005/08/blacks-more-likely-to-be-hardcore.html>; [http://findarticles.com/p/articles/mi\\_m0PJQ/is\\_15\\_2/ai\\_n6131152](http://findarticles.com/p/articles/mi_m0PJQ/is_15_2/ai_n6131152)). People have argued that video games are, for some young people, a route to IT and STEM skills, if these young people think about them strategically and involve themselves with “modding” (modifying and making games). *GameStar Mechanic* is all about modding and one of its goals is to ensure that minority boys and girls get the opportunity to engage with games in a way that leads to IT and STEM possibilities.

## Epistemic games

The approach to learning built into the *Gamestar Mechanic* project is one that has been advocated for by the Games, Learning, and Society Group at the University of Wisconsin-Madison. One version of this approach can be seen in David Williamson Shaffer’s “epistemic games” or “professional practice simulations” (Shaffer, 2007). Another such approach can be seen in James Paul Gee’s work on “games and authentic professionalism” (Gee, 2007) or Kurt Squire’s (2006) work with young people “modding” (modifying) the complex game *Civilization*.

In “epistemic games”, learners use game technologies to take on the identities and practices associated with some professional domain, whether this domain be urban planning, architecture, journalism, and so forth, or, in the case of *Gamestar Mechanic*, game design itself. The purpose is not professional training, however; rather, it is for young people to be immersed in a distinctive domain of knowledge and skills that can transfer to school and, more importantly, life.

In such games, learners do things that have meaning to them and to society. Such games are *knowledge games*. They are meant to teach learners both how to navigate complex linguistic, cognitive, and symbolic domains and to innovate. Both of these goals involve becoming part a group—a “community of practice”—with a common repertoire of knowledge about problems in the world and a shared set of skills to enact this knowledge.

To illustrate such an “epistemic game”, consider *Madison 2200*, a computer-based simulation in which high school participants work (“role play”) as urban planners to redesign a local downtown pedestrian mall (think of a more accurate and local *Sim City*), developed by David Shaffer and his participants at the University of Wisconsin-Madison. Urban planners develop and use plans that meet the social, economic, and physical needs of communities. Urban planning requires deep understanding of both social and scientific issues and it requires the use of sophisticated technologies to solve complex problems, including geographic information systems (GIS) that make it possible for planners to ask creative “what if” questions and get feedback to inform their work.

In such an epistemic game, participants don’t just use a game-like technology to engage in urban planning, they are provided with a rich set of additional curricular materials and activities. For instance, they receive a project directive from the mayor, addressed to them as city planners, directing them to create a detailed re-design of the local pedestrian mall. They receive, as well, an information packet including a city budget plan and letters from concerned citizens about issues such as crime, revenue, jobs, waste, traffic, and affordable housing. They watch video featuring interviews with people about the street’s redevelopment and they conduct a site assessment. They work in teams and their emerging understandings are guided by adults with knowledge about learning, about the specific skills urban planning recruits, and about ways to leverage those skills for the development of school-based language and thinking skills.

*Gamestar Mechanic* is an epistemic game of a very distinctive and innovative sort, one that speaks quite directly to the issues of being tech-savvy in the modern world and of media literacy that we discussed above. But the work on epistemic games also brings forward two important features that any games for learning must have: first, learning stems not from the game in and of itself, but from the learning system (forms of social participations and interaction, curricular materials, teaching-learning relationships among masters and peers) into which the game is placed; second, good learning games need to be integrated with “communities of practice” or “affinity groups” (Gee, 2004) where learners can participate in developing a common set of high standards and engage in collaborative reflection and production.

## Learners as producers of knowledge

*Gamestar Mechanic* is part of larger movement today that stresses young people as producers, not consumers of knowledge and media (Jenkins 2006). Thanks to modern digital technologies, young people today—if they are willing to put in the effort—can produce media (video, machinima, music, animation, graphic arts, modded games, blogs, wikis, and so forth) at a professional level. They can join robust communities or affinity groups where people’s status is determined by their skills and often their ability to help, teach, and collaborate, not their age, race, gender, or school success.

Such production often leads young people today to become “tech-savvy”, by which we mean technologically skilled, unintimidated by technical and technological matters, and able to integrate technology into artistic or social concerns. In turn, such tech-savvy identities are crucial for success in the modern world. A real issue arises though of the social distribution of production skills and tech-savvy identities among young people today. Are all children getting these opportunities or only the more privileged ones? How does gender work in this respect? What if young people today pick up tech-savvy skills and identities primarily out of school? What if schools do not, for the most part, offer kids tech-savvy identities and skills?

*Gamestar Mechanic* can be viewed as a game about “modding”, as a tool meant to engage young people with a “modding” attitude. “Modding” is the term gamers use for the practice of using the software by which games are made—software today is very often readily available when one buys a game—to modify a game, sometimes in small ways and sometimes in major ways, major enough to constitute a wholly different game. For example, young people at MIT, under the direction of Henry Jenkins, made a game about the American Revolution from the software with which the *Dungeon and Dragons* game *Neverwinter Nights* was made. Modding is a quintessential tool that can lead a young person to take on a strong identity as a producer and a tech-savvy individual, almost always today as part of a collaborative effort among a community of modders and players.

From the little evidence that has so far been collected about the matter, modding at the highest levels—though not in its more modest forms—is very probably strongly associated with a relatively small set of privileged young people, often males. *Gamestar Mechanic* is meant to spread the modding attitude and its attendant skills and values. It is meant to lead to young people transferring the modding attitude to other technologies and settings.

The Games, Learning, and Society Group at the University of Wisconsin-Madison has advocated a productive approach to media literacy that is epitomized in modding and the modding attitude to technologies. Kurt Squire has shown that even quite young children—children from poor communities and who are unaffiliated with school—can become active modders of a game like *Civilization*, a game that requires the modder to think deeply about culture, history, and geography (Squire, 2006).

## Research Design

This *Gamestar Mechanic* research project employs a design-based research program (Brown, 1992; Collins, 1992), which is an iterative approach to research allowing for flexibility to adapt or redesign research procedures during the course of the research program. This approach attempts to investigate an intervention through a particular theoretical lens with an intent to make further claims about theory (Barab, 2006; Barab & Squire, 2004). In our case, the work on situated learning (Gee, 2004; Lave & Wenger, 1991) frames the theoretical framework to which we wish to further contribute. Pioneered (Collins, Joseph, & Bielaczyc, 2004) by Brown (1992) and Collins (1992), design-based research treats as fundamental the problem of context (Hoadley, 2004) and entails both "engineering" (Cobb, Confrey, diSessa, Lehrer, & Schauble, 2003) particular forms of learning and, in a systematic and iterative fashion, studying those forms of learning within the very context defined as the means for supporting them. In this way, design-based research ideally results in greater understanding of the design elements of a learning ecology and constitutes a means of addressing the complexity that is especially characteristic of educational settings. Our intent, as is the nature of design-based research projects, is to investigate the possibilities of *Gamestar Mechanic* as an educational intervention for the explicit purposes of educational improvement. Research for *Gamestar Mechanic* began in early 2007 and will continue through 2009.

## Sample

Starting in January 2007, *Gamestar Mechanic* has been tested in six "workshop" settings. Workshop participants have ranged in ages 9 to 16, and have included gender-balanced samples from varying socioeconomic backgrounds. In all, about 70 middle and high school participants have participated in workshops in various sites, including Madison, Wisconsin, New York City and Minneapolis, Minnesota. Workshops ranged from 16 two hour-long sessions over the span of several weeks to more intensive week-long sessions totaling 20 hours. Using *Gamestar Mechanic* as a central mediating game tool, the workshops were designed to immerse participants in the *epistemic* domain of game design, asking participants to engage in and take on behaviors particular to game designers. Specifically, the following nine goals have defined the design of the workshops:

1. To teach basic game design principles using *Gamestar Mechanic* as the primary learning platform.
2. To use activities that make up the *Gamestar Mechanic* experience—indeed, that are endemic to the domain of game design—as the basis for the workshop: making games, sharing games, writing game labels, conducting game reviews, doing game design challenges and playing challenges.
3. To instantiate the domain of game design where participants in a highly social and collaborative environment iteratively design and critique games.
4. To continue to refine assessment tools for the project, including strategies for documentation and evaluation of the kinds of thinking and creating encouraged and supported by *Gamestar Mechanic*.
5. To define core exercises and structures for a *Gamestar Mechanic* curriculum in a facilitated setting.
6. To test new features of the build, including levels and parameter modification.
7. To document participants' use of *Gamestar Mechanic* in a facilitated context.
8. To gather information on participants' pre-workshop and post-workshop understandings of how games work as designed systems.
9. To see if participants can learn to think critically about their design choices and to see games as a system of designed choices.

## Assessment and data collection tools

Thus far, nine assessment and data collection strategies have been used in this study. They include (1) games designed by participants; (2) written game description participants create for their games; (3) video recording of all workshop meetings; (4) pre and post assessment sessions with each participant; (5) game reviews where participants in writing decompose and critique the design of their own games and the games of other participants in the workshops; (6) writing prompts; (7) think-aloud protocols (Ericsson & Simon, 1984, 1993); (8) video screen captures taken as participants design games; (9) field notes.

## Research questions

The following research questions have driven the collection of data:

1. Does participation in *Gamestar Mechanic* workshops enable participants to acquire and use technical language specific to game design?
2. Are participants able to demonstrate understanding of a game as a system of interacting elements? Is *Gamestar Mechanic* able to help participant's develop systems-thinking skills?
3. Are participants able to take on and exhibit the behaviors of game designers?

## Preliminary Findings

### 1. Does participation in *Gamestar Mechanic* workshops enable participants to acquire and use technical language specific to game design?

The highly iterative nature of design-based research has allowed us to modify the design of workshops from one to the next. In one of the early workshops, our interest in allowing participants to openly explore designing games with the software, led us to wait a few weeks before introducing core game design concepts, such as the design of rules, goals and core mechanics. While participants were able to complete assignments that demonstrated understanding of core mechanics, for example, they did not demonstrate facility with the use of technical terms. That is, they did not use the technical language particular to game design unless prompted. In contrast, during a subsequent workshop, participants were introduced to a framework of technical terms as functional tools for engaging with and talking about game design, early in the workshop. This framework not only highlighted technical terms, but drew systematic relationships between the terms. Enabling participants to develop an understanding of a game as a system of interacting elements has been a driving focus of this project. Hence, early in the workshop participants were introduced to a set of five design concepts (rules, space, core mechanics, components and goals) as discreet elements that, taken together, create the design of a game's system. While the use of these pedagogical strategies have yet to be analyzed further, participants have begun to show encouraging results. Post-assessment results have indicated that workshops have enabled participants to demonstrate facility with technical language, not in terms of memorized vocabulary and set definitions, but as functional language within the professional practice of game design. During pre and post assessments, for example, participants were asked to explain what a game a designer does. A response given by one participant (below), which was typical of responses given by other participants, indicates a level of acquisition of technical terms specific to the domain of game design:

A participant's post-assessment response to "What do game designers do?":

Game designers design and edit games. They set up a system of core mechanics, rules, space and objects of the game.

This is in contrast to his pre-assessment response, which was more general:

They lay out the groundwork, design, plot, and other things necessary for a game to work. They help with the game programming process. They are the head of a team of designers and developers.

While we are only in the first of two phases of research, data is showing that the highly situated nature of learning in *Gamestar Mechanic* seems to enable participants to acquire and apply complex game design concepts and technical language particular to the domain.

### 2. Are participants able to demonstrate understanding of a game as a system of interacting elements? Is *Gamestar Mechanic* able to help participant's develop systems-thinking skills?

Data collected is also showing promising results in participants' abilities to conceive of games as systems of interacting elements. One workshop used daily morning reflections to assess participant progress. Morning reflections consisted of prompts to which participants gave written responses. One prompt asked: *If you were to think of a game as elements that make up a system, how would you describe those elements and their interactions?* One participant (who we will call John) responded:

A set of rules is set to keep the interactions with the space, goal, and components logical and more difficult. The components are placed in the space to create strategic solutions in finishing a goal. The core mechanics are actions within the space and components to help achieve a goal. A goal is a way to complete a level or game that has specific rules to make the game harder. The space is the environment, in which all the other elements of the system coincide.

A different participant (who we will call Patrick) responded:

The elements are space, goal, core mechanics, and rules. By changing an element, such as the core mechanics, it will change all other elements such as the goal. For example, if the core mechanics were changed from killing to jumping then the goal would have to change from killing all the enemies to jumping to the end of the level.

In John's response, he draws significant connections between the various elements of a game system (e.g., "A set of rules is set to keep the interactions with the space, goal, and components logical and more difficult"), making clear that he is able to exhibit systems-thinking skills. Patrick's response shows clearly the level of sophistication that participants began to achieve by the middle of a workshop. In the case of this participant, he was not only able to analyze the structure of a game using technical terms, but he was able to contextualize his response using a game example, demonstrating his mastery over what Gee (2003) calls the *design grammar* of a game. While these participants' responses are only typical of approximately 30 percent of responses within a particular sample of 15 workshop participants, this type of response represents the potential this game platform offers in enabling users to develop systems-thinking skills. Moreover, it allows us moving forward to consider the types of scaffolding that may be required to support more participants in reaching these high levels of understanding.

### 3. Are participants able to take on and exhibit the behaviors of game designers?

A core design goal of *Gamestar Mechanic* is to enable a "metagame." By this we mean the instantiation of a larger community in which participants share and critique each others' games as part of an emerging community of practice. Players engage in such critique based on a set of "good game" criteria established by the community. In this way, players elicit feedback on their designs as well as offer feedback to others. This metagame aspect of the game has demonstrated significant potential as the vast majority of participants have demonstrated the ability to fruitfully iterate and improve their game designs based on peer feedback. Playing, designing, eliciting feedback and critiquing games are behaviors we define as core to the practices of professional game designers. Data from this first phase of testing has demonstrated that *Gamestar Mechanic* is indeed able encourage these behaviors among most participants. Post-assessment interviews, for example, have recorded participants uttering statements like, "I feel more like a game designer now," and "I want to change what I said about game designers [during the pre-assessment interview]." Moreover, participants' use of technical language related to game design (discussed above) also point to the potential of *Gamestar Mechanic's* ability to facilitate the kind of language uses characteristic of game designers. As pedagogical tool, *Gamestar Mechanic* attempts to activate a community of practice by imbedding into the tool's design the structures that typically support and define the domain of game design (e.g., iteratively designing games, accounting for variability change within a game's system's elements, critiquing games, etc.). Overall, we are encouraged thus far by the results of our first phase of testing.

## **Design of Interactive Session**

This interactive session will consist of a condensed version of a game design workshop. A three-part structure will be used to facilitate this session:

- I. Introduction to *Gamestar Mechanic* and Overview of Research Methods and Findings (45 min)
- II. Enacting a *Gamestar Mechanic* Metagame (30 min)
  - a. Participants iterate through two game design cycles
  - b. Teams present their game to other teams and a vote is cast for the best game.
- III. Discussion and Question and Answer Session (15 min)

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