Gameful learning as a way of being

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Abstract
As a variation on game-based learning, we propose the concept of "gameful learning" as a framework that encourages improvisation, playfulness, and social interaction, and which takes into account the unique contingencies of individual people and specific content. We describe gameful learning in terms of three elements: attitude, identity, and ignorance. Three cases of gameful learning are examined across diverse learning environments: a fourth grade science class studying matter, a secondary world history class studying the Middle Ages, and an educational technology graduate program. Cross-case analysis reveals how gameful learning elements relate to attitudes of agency and social necessity, becoming a game designer, and embracing ignorance for learning.

Keywords: Gameful learning, lusory attitude, identity, critical perspectives on knowledge, ignorance, case studies, game design, teacher learning, teacher research

1 Introduction

> *There was a combination of strain, expectation, enthusiasm, and some fear in the air. The collective nature of our endeavor involved not only that everybody had to … play within the overall changing texture, but that each participant also had to achieve a level of feeling at ease doing so. I remembered Robin Engelman's words: "I have experienced the feeling of becoming [what] I have been playing… the feeling of literally losing your identity". … [P]eriods of inactivity, dubitation, and weakness interrelated with moments of resolution and fiery activity. There was a nutritious dialogue going on. We were opening a realm of dialogue and exchange. We were building a social reality and a culture…. our own version of the world. (Odria, 2011, p. 55-56)*

For those of us interested in games and play, the preceding paragraph conjures images of experienced players immersing themselves in a game, perhaps around a console or computer. The description fits well with research on how complex thinking and social cognition occurs regularly in game play, such as Chen's (2009) *World of Warcraft* ethnography that followed raid group performance, Squire's (2011) recollection of corpse retrieval navigation in *Avatar*, groups "modding" (cf. Prensky, 2003) games to create personalized virtual worlds, and other studies (e.g. Gee, 2007; Salen, 2008; Shaffer, 2006).

But this particular description was not an observation of virtual hordes, video games, or enemy crowd control. Rather, it described[1] jazz musicians improvising. The similarities between musical improvisation and game play are not accidental; rather, common elements inform our understanding of the power of games as learning experiences. Improvisation is an empathic interaction resulting from extensive absorption of knowledge, convention, and wisdom about tools, self, and social environments. Improvisations in concert with others demand experience, skill deployment, and deft expressivity within a dynamic and shared context. Whether in sketch comedy (Fey, 2011), narrative games (Jenkins, 2004), or jazz, multiple playful improvisations foster "cohabited space for embodied collective learning" (Stanyek, 2004, p. 95).

Game-based learning exemplifies cohabited collective learning. But researchers have only begun to articulate how such learning relates to broader theories of play and to evolving uses of technologies for learning and for game play (Gee, 2013; Gee & Shaffer, 2010; Gredler, 2004). Furthermore, at a time when research on educational gaming increasingly emphasizes quantifiable outcomes and "serious content", how can we take into account the "uncertain outcomes [and] multiple possibilities" of game play (Sousanis, 2012)?

Advances in learning analytics (e.g. Nash & Shaffer, 2011) aligned with preferences for "scientific" education research (cf. Lather, 2004) have buoyed empirical quantification of games' academic benefits, particularly video games (e.g. Barab, Goldstone, & Zuiker, 2009; Ke, 2008; Peterson, 2010). Yet Young and colleagues' (2012) meta-analysis of video games supporting academic achievement illustrates the state of the art alongside prevailing limitations:

> There is limited evidence to suggest how educational games can be used to solve the problems inherent in the structure of traditional

[1] The passage was edited to remove obvious references to music.

> K–12 schooling and academia… current methodologies must extend beyond their current parameters to account for the individualized nature of game play, acknowledging the impossibility of the same game being played exactly the same way twice. (p. 62)

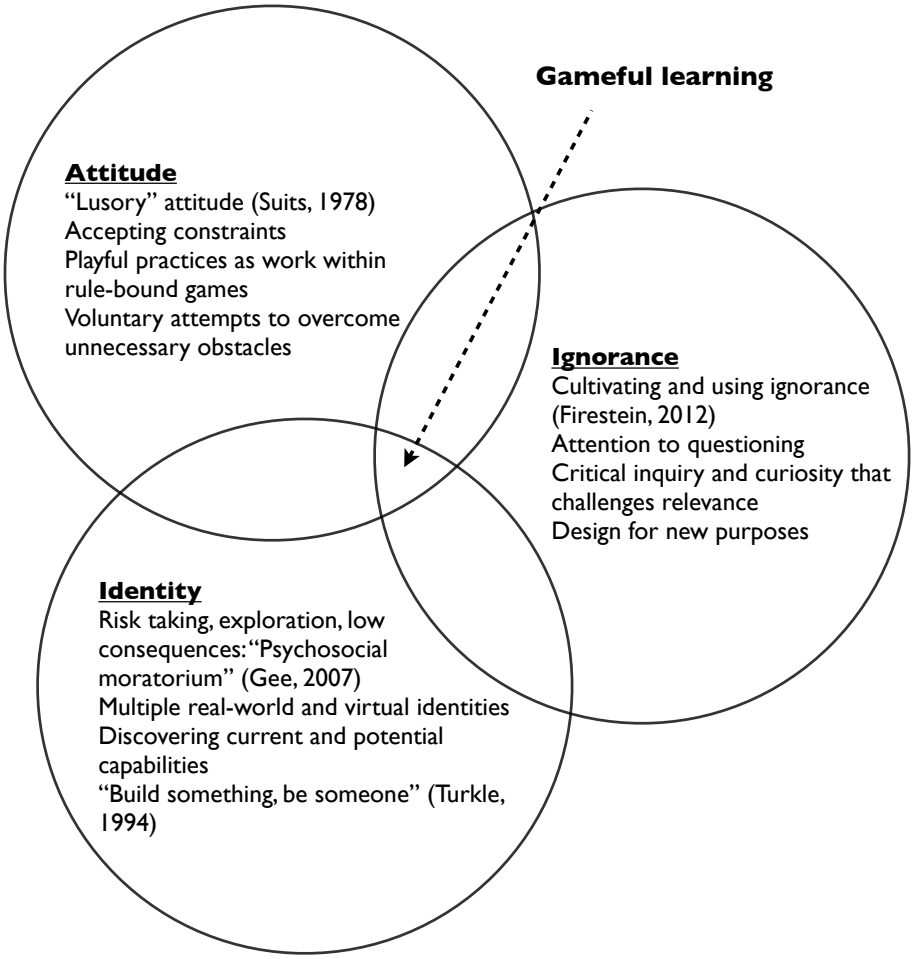
Despite shortcomings, advocates of "serious" games – defined as games with primarily educational rather than entertainment goals – argue that real-world social, political, and ethical dilemmas advance student learning (Breuer & Bente, 2010; Ratan & Ritterfeld, 2009). Yet early childhood scholars have long documented the sophistication of play (e.g. Paley, 2004; Sutton-Smith, 2005; Vygotsky, 1978). Online role-playing simulations – regardless of "serious" content or learning goals – can provide "an opportunity to take our students' explorations seriously… They provide safe bubbles where students (and teachers) can take risks and try out different ways of thinking" (Kupperman, Fahy, Goodman, Hapgood, Stanzler, & Weisserman, 2011, p. 29). Whether video games are designed and researched to prove measurable achievement or promote prepackaged "serious" content, such trends assume play is a means for a priori learning ends and game-based learning is best constrained as a function of more desirable educational outcomes.

Experimental musician George Lewis' (2000) analysis of cooperative improvisation provides insight into game-based learning. While singular improvisation may be incorporated into and used by other music types, pluralistic embodiment of improvisations within shared collaborations welcomes "agency, social necessity, personality and difference" (p. 37). Similarly, cooperative game play invites creativity, collaboration, and strategy. This article – a "cohabited space" among authors – illustrates and articulates a plural vision of agency, social necessity, personality and difference at the intersection of games, learning, and digital media. We propose that this approach to game-based learning – emphasizing improvisation, playfulness, and social interaction, and taking into account individual contingencies and specific content – be called "gameful learning".

2 Gameful Learning

Our research advances gameful learning as one interpretation of game-based learning. Embracing commitments to plurality, personality, and difference, gameful learning serves as inspiration for other practitioners' literal and figurative play, rather than a prescriptive construct to be reified. Some might conflate gameful learning as a variant of a trend in gamification, or the use of game design elements in non-game contexts (Deterding, Dixon, Khaled, & Nacke, 2011). Gamification, however, often concerns designing extrinsic and formulaic motivation outside school settings (e.g. Kapp, 2012); gameful learning, alternatively, seeks to describe why teachers and students are intrinsically motivated to play, experiment with identity, question, and learn – all within school. The primary objective of this dynamic framework is synthesizing multiple influences into a teaching and learning "way of being" with games, digital media, and play. Our conception of gameful learning includes three overarching elements: attitude, identity, and ignorance (Figure 1).

Figure 1 Elements of gameful learning



2.1 Attitude

Musicians regularly practice set forms – scales, rhythms – as a means of playing. So too do athletes practice drills to develop skills and "plays" for competition. In each, the work of practicing affords the joys of playing. Maria Montessori's (1964) adage, "Play is the child's work" (p. 53), influenced Elkind's (2007) assertion that children's play and work can, but do not always, occur simultaneously. Play and work do coincide within games. Johnson and colleagues (2005) describe this confluence in the game checkers:

> Children are working in the sense of accommodating to the social world of agreed-upon terms for the conduct of the game… the checkers that are captured or lost have no intrinsic worth or power in the real world. It is the personal investment of transforming the objects of the game into signifiers of importance and power that makes engaging in the activity fun and exciting – playful. (p. 12-13)

As musicians accept the constraints of scales and time signatures and make harmonic meaning, game players make meaning by accepting rules. An important element of game play is an

attitude of intentionally accepting constraints (e.g. the rules of checkers) that make it more difficult to reach a particular goal (taking an opponent's checkers). The philosopher Bernard Suits (1978) observed about games, "There has to be an explanation of that curious state of affairs wherein one adopts rules which require one to employ worse rather than better means for reaching an end" (p. 52). Whether diagonally jumping an opponent's checker, or selecting a virtual avatar's characteristics, specific "constitutive rules" prohibit more efficient and productive means of achieving a goal. Yet those constraints allow the game to exist, and for play to have meaning. When players voluntarily accept constraints to instantiate play, they adopt what Suits calls "lusory attitude".

Gameful learning cultivates lusory attitudes to establish conditions for the work of learning. Whether formal and codified or fluid and improvised (as with children's "make-believe"), attitudes encouraging the work of playful practices should be neither "tedious" nor "barely noticed" (cf. Paul, 2013). Lusory attitudes can foster enjoyable, voluntary, and focused attempts to play with tools, academic content, and identities.

2.2 Identity

Gameful learning thrives when environments encourage experimentation with multiple identities. Identity play is featured throughout game-based learning research. Squire's (2008) framework for game-based learning environments asserts that open-ended simulations (i.e. *Civilization*) are "possibility spaces" allowing players to "try on", embody, and create new identities. These identities provide participatory trajectories from within the game world out towards players' non-game "life spaces", like school and neighborhood (e.g. Barron, 2006). Before massively multiple online role-playing games were shown to "script" online identity performance (Steinkuehler, 2006), Turkle (1994) noted that through video game play "people are exploring, constructing, and reconstructing their identities. They are doing this in an environment infused with a postmodern ethos of the value of multiple identities and of playing out aspects of the self and with a constructionist ethos of 'Build something, be someone'" (p. 166).

One means of understanding identity play is through Gee's (2007) learning principles. Video games are designed spaces with lowered real-world consequences, where players "are encouraged to take risks, explore, and try new things" (p. 216). This "psychosocial moratorium" underscores the importance of fast failure within games (e.g. Salen & Zimmerman, 2003). When virtual game worlds are constructed to promote risk-taking, players learn about themselves, and current and potential capacities – whether those selves are half-elf or biologist, and capacities concern warfare or scientific analysis. What Gee (2007) describes as a "tripartite play of identities" among multiple real-world, virtual, and projective identities fosters new ways of thinking about self, potential, and social relations (e.g. Compton-Lilly, 2007).

As players navigate and negotiate identities across multiple "sites", identity play becomes relevant to games, in and outside of schools, within workplaces, and throughout various environments. Because game players, not unlike musicians or citizens of any clan, live and learn as "members of multiple lifeworlds, so their identities have multiple layers that are in complex relation to each other" (New London Group, 1996, p. 71), identity play is social activity to be embraced within and beyond virtual worlds and classroom walls.

2.3 Ignorance

Writing about the relationship of science to ignorance, neurobiologist Stuart Firestein (2012) shares the parable of a gentleman who, upon dropping his keys in the road late at night, is approached by a stranger who helps search beneath a streetlight. Unsuccessful, the stranger asks the gentleman whether he is sure they are searching in the right place. The gentleman replies, "No", points to a darkened area further away, and confesses the light is better where they stand.

A similar version of this story opens Gee and Shaffer's (2010) critique of standardized testing, a "regime" failing to embrace digital technologies. It is possible, they argue, to design games to test complex problem solving skills and track achievement over time – yet this requires perceiving assessment differently, or elsewhere. In effect, turn from "well-lit" habits toward the unknown, from assessments sorting students toward an appropriate "new paradigm". By questioning what schools assess and why tests are administered, Gee and Shaffer attend to ignorance "of the next decimal place" (Firestein, 2012, p. 68), or increased scrutiny, "measurement and exactitude" about enduring questions – questions, in their case, about video games and assessment.

The need to question, to actively cultivate high-quality ignorance, is a third gameful learning element. For Firestein (2012), scientific inquiry is a "portal of ignorance", created by "ideas like connectedness, solubility or tractability, and others like measurement, revisiting settled questions, using small questions to get at big ones, curiosity" (p. 81). This "jumble" of strategies is useful for questioning relationships among games, digital media, and learning. Gameful learning assumes educators – like scientists – are capable of questioning, of "having faith in uncertainty, finding pleasure in mystery, and learning to cultivate doubt" (Firestein, 2012, p. 17). Whereas gamification often rewards correct answers, gameful learning motivates inquiry and embraces questions about unknown possibilities.

3 Methodology

We have characterized gameful learning by three elements: an attitude accepting constraints to make possible enjoyable play; identity play with multiple real-world and virtual selves revealing new capacities; and ignorance that embraces questions to transform learning. What, then, does gameful learning look like? How might it be described? We engage these questions through qualitative case studies that examine the practices by which individuals make decisions in a single instance (Yin, 2009).

Before presenting our cases, we recognize two limitations of the forthcoming analysis. First, our articulation of gameful learning is a descriptive schema; it was not a rubric that guided game or research design. Second, gameful learning may more or less suitably describe particular game-based learning environments. The cases below feature games based upon role-play and collaboration in blended school settings; future research should refine this conceptual prototype in relation to contexts like virtual game worlds. These limitations notwithstanding, we turn to discuss authorship and research context, narrative style, and definitions of tools (Table 1).

Table 1 Summary of case studies

Case, game	*Author*	*Research context*	*Case narrative style*	*Tools*

1, Matter Quest	Saunders	4th grade science Unit length: 2 months Total classes: 3 Total students: 75	Teacher as character ("Creepor the Emissary"), observation of unit implementation	Class wiki Laptop computers Digital audio Digital video
2, Kingdom Quest	Pratt	Secondary world history Unit length: 3 weeks Total classes: 1 Total students: 15	Teacher as game designer, within-case analysis of "cheats" (lessons learned)	Class wiki Laptop computers Digital audio Digital video
3, POST Cards	Dorfman & MacKay	Educational technology (MA) Program length: 16 months Total classes: 1 (cohort) Total students: 20	Game-based dialogue, reflection on teaching and learning practices	Digital representation of analog playing cards

3.1 Authorship and research context

Our collaborations emerge from an educational technology graduate program that designs learning environments, activities, and tools for use in classrooms and other contexts. Three members of our team (Saunders, Pratt, MacKay) are alumni of the program, and three are faculty (Holden, Kupperman, Dorfman). We believe teachers are researchers capable of contributing to education scholarship (e.g. Cochran-Smith & Lytle, 2009), and are inspired by educators studying game-based learning (e.g. Coulter, 2012; Mathews, 2010; Sheldon, 2011). Our cases were originally researched, and are also authored, by: Saunders, a fourth grade science teacher in a mid-sized town in the Midwestern United States; Pratt, a secondary social studies teacher in a mid-sized town on the East Coast of the United States; and Dorfman, a teacher educator, and her former graduate student, MacKay, who reflect upon the common graduate program.

3.2 Narrative style

Just as improvisations celebrate individual agency, personality, and difference, so too do we embrace playful approaches to narrative style. The first case is narrated by "Creepor the Emissary", a character Saunders role-played when teaching a states of matter science unit. The second case features Pratt as game designer offering within-case analyses ("cheats") about teaching a Middle Ages unit. The third case is an exchange between Dorfman and MacKay, who adapted a card game to structure reflection about graduate education. We intentionally chose divergent and unconventional narrative styles to "play with" and interpret game-based learning as gameful learning.

3.3 Tools within context

Gameful learning views tools as designed and situated within the activity of authentic contexts (Brown, Collins, & Duguid, 1989). Pea (1993) suggests authentic contexts, like classrooms, are "thick with invented artifacts" as mediating structures, and include a range of "tools" from physical technologies to social relations. We do not examine a single game implemented across different environments, and our cases do not empirically prove gameful learning. While each

case and game is unique, our affinity with "ecosystemic design" is a reminder to "use the properties of the context to help us do our work" (Brown & Euchner, 2012, p. 21). Like some scientific inquiry, we created games and research contexts to "glimpse" the "emergent phenomenon" of gameful learning – and "engineering them, glimpses, is the subtlest kind of experiment that one can design" (Firestein, 2012, p. 98). Our cases are "glimpses" of gameful learning.

4 Case Studies

In this section we present three cases of gameful learning from elementary, secondary, and higher education settings. Each features multiple tools, teaching and learning processes, and elements of attitude, identity, and ignorance to delineate gameful learning as a way of being.

4.1 Matter Quest

Our first case is authored by Saunders writing as "Creepor the Emissary", a character he created and role-played while teaching about the states of matter with three fourth grade science classes.

> Greetings, Earthlings! I am Creepor the Emissary, of the Deep Galactic Core, First of the Matter Questers. I have crafted an insidious device designed to easily engage and capture the minds of your elementary students: Matter Quest!
>
> Observe the classroom of this human teacher. Before my intervention, his classroom of fourth grade students received instruction directly from him. Labs progressed in whole-class settings. Feedback was often late in coming, and re-teaching opportunities were non-existent. In trying to manage materials and students, ineffective learning was engendered. There was little room for students to create or dig deeper. It was painful and boring to watch; he and his students were ripe for Creepor's intervention.
>
> After infecting the teacher's mind, his little brain was easy to manipulate – aided, that is, by Sheldon's *The Multiplayer Classroom* (2011). From there it was – as you say – child's play. His states of matter unit, developed by a local math and science center, featured many hands-on lab experiences for students. Yet the unit lacked an overarching narrative, small-group and individual learning opportunities, and non-fiction reading; it was a prime opportunity for redesign.
>
> To craft a game-based unit, the teacher transformed unit labs into levels. Students completed levels to gain experience points. Guilds (student learning groups) were formed, and successful completion of levels was dependent upon content mastery – much like video game levels that require completion to unlock and "level up". The teacher remixed whole-class "sage on the stage" instruction with "guide on the side" facilitation. Taking advantage of a district one-to-one laptop pilot program, the teacher embedded all labs within an online wiki. Rather than receive a list of lab materials and directions from their teacher, students now gathered unit information online.
>
> To create the narrative, the teacher looked no further than Creepor! To aid the narrative development, I visited each of his three science classes as the unit commenced. Afterwards, my video messages were embedded within the wiki at

the beginning of each lab. These messages included riddles and clues for student problem solving. 12 riddle answers formed a larger message for students, warning them of my true intentions. Let it not be said that Creepor does not give his future underlings a fair warning!

Through my omniscope I observed the teacher interact with little Timmy Human and sweet Betty Bipedal as they were introduced to mass. Timmy and Betty, guild companions with two others, created a working balance out of ruler, nail, masking tape, paper clips, and paper cups. They recorded a podcast about their learning, after sitting on the floor of a quiet hallway, rehearsing a script, and revising lines. Betty used her laptop to record the podcast. After multiple false starts they recorded a version that all guild members agreed represented their best work. Timmy uploaded it to their wiki (Figure 2).

Figure 2 Students recording podcast to embed in class wiki

In order to advance levels, students assembled in guilds to share completed labs, readings, and learning reflections. Should any lab work demonstrate a lack of understanding, students were directed to revise or retake relevant portions before advancing. Once mastery was demonstrated, each guild received a password to the next wiki level.

The teacher was now able to move from guild to guild as students worked through labs; he freely observed and offered advice to different groups as they explored successive labs and readings. There were few groups that required substantial redirection at the end of a level. Thanks to my intervention, the class is now a bubbling cauldron of exploration, collaboration, and engagement. Students are motivated by the hands-on nature of the science labs, as well as the narrative story and video riddles that I, Creepor, leave them. How long will it be until I conquer all of the teacher's science classes?

4.2 Kingdom Quest

Our second case is authored by Pratt who, as game designer, shares within-case analyses in the form of "cheats" about teaching a Middle Ages unit.

> *I am the Game Master. I will issue Quests and Challenges for your kingdom to complete. I am all-powerful and all-knowing. I control the weather, inter-kingdom communication, and much more. You must do your best as a kingdom to complete each quest and achieve World Domination. Do not cross me; the consequences could be devastating for your kingdom.*

As the "Fantastical Empress Prattina", I wrote the above on our wiki to introduce my world history class to Kingdom Quest. As game director, teacher, and game designer, I embodied multiple selves and unlocked many secrets that I would like to share.

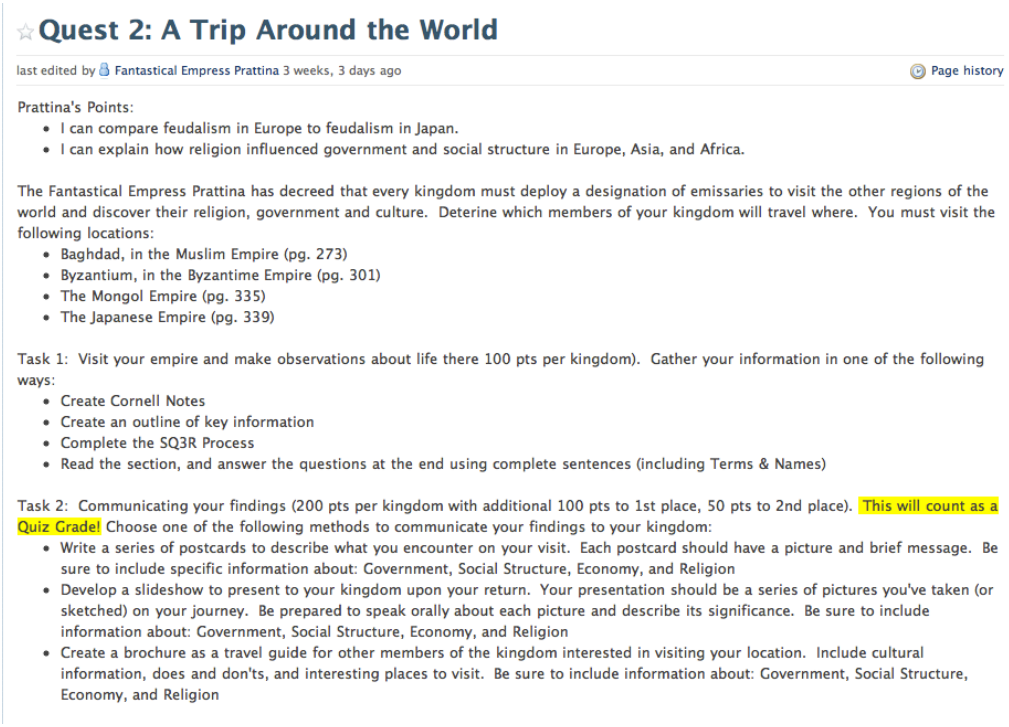
Cheat #1: Characters complement context. Storyline is beneficial to character-centered historical games like Kingdom Quest. My students assumed the roles of historical figures and stepped outside their everyday selves to analyze events and solve problems from multiple perspectives. Students were assigned to both a kingdom (team) and position within feudal society: serf, peasant, knight, lady, king, or queen. Privileges and duties accompanied each character within kingdoms. Students' first quest involved creating avatars, researching feudal positions, and writing daily journals from their character's perspective. Our wiki afforded an alternate reality for game play; students used the wiki in character and all quests were completed from character and kingdom points of view.

Within our classroom context, reciprocal teaching reinforced student ownership of unit material. Feudalism, for example, ceased to be an abstract concept and permeated students' understanding of social relations. Students were required to ask each member of their kingdom for help before consulting me. Students moved up the feudal hierarchy with their questions, from serf to royalty. All kingdom decisions required the consent of king and queen. Dividing responsibilities and privileges allowed students to develop leadership, collaboration, and consensus-building skills. As one student commented, "I like learning this way because it's a lot more interactive and creative than regular classroom instruction. I think I understand better because I interact with the lessons more".

Cheat #2: Points don't matter. While points structured and added context to game play, they were not attached to real-world consequences like grades. As play progressed, points allowed kingdoms to unlock additional powers and perils in successive levels. For example, in Level 2 the black plague spread across the world when (paper) rats carrying the disease were attached to chairs. In Level 4, kingdoms unlocked the power of the Magna Carta, and all lords and ladies voted on monarch decrees. Awarding points to kingdoms rather than individuals prevented students from feeling excluded. Additionally, assignments that students completed during quests were assessed using separate rubrics. Ultimately, it was enjoyment of the game and dedication to teammates that motivated students – not the points. As one student explained, "I really like the game. It's so much fun I even complete quests online when I'm absent to make sure I'm not letting down my kingdom".

Cheat #3: Games have unknown outcomes. As a character and game designer, I abandoned my "sage on the stage" role and recast myself as facilitator and co-learner. Doing so, I embraced outcomes unfamiliar to my traditional role – even while structuring quests and related tasks (Figure 3).

Figure 3 Kingdom Quest wiki screenshot indicating structure of quests and tasks



Quest 2: A Trip Around the World

last edited by Fantastical Empress Prattina 3 weeks, 3 days ago — Page history

Prattina's Points:

- I can compare feudalism in Europe to feudalism in Japan.
- I can explain how religion influenced government and social structure in Europe, Asia, and Africa.

The Fantastical Empress Prattina has decreed that every kingdom must deploy a designation of emissaries to visit the other regions of the world and discover their religion, government and culture. Deterine which members of your kingdom will travel where. You must visit the following locations:

- Baghdad, in the Muslim Empire (pg. 273)
- Byzantium, in the Byzantime Empire (pg. 301)
- The Mongol Empire (pg. 335)
- The Japanese Empire (pg. 339)

Task 1: Visit your empire and make observations about life there 100 pts per kingdom). Gather your information in one of the following ways:

- Create Cornell Notes
- Create an outline of key information
- Complete the SQ3R Process
- Read the section, and answer the questions at the end using complete sentences (including Terms & Names)

Task 2: Communicating your findings (200 pts per kingdom with additional 100 pts to 1st place, 50 pts to 2nd place). This will count as a Quiz Grade! Choose one of the following methods to communicate your findings to your kingdom:

- Write a series of postcards to describe what you encounter on your visit. Each postcard should have a picture and brief message. Be sure to include specific information about: Government, Social Structure, Economy, and Religion
- Develop a slideshow to present to your kingdom upon your return. Your presentation should be a series of pictures you've taken (or sketched) on your journey. Be prepared to speak orally about each picture and describe its significance. Be sure to include information about: Government, Social Structure, Economy, and Religion
- Create a brochure as a travel guide for other members of the kingdom interested in visiting your location. Include cultural information, does and don'ts, and interesting places to visit. Be sure to include information about: Government, Social Structure, Economy, and Religion

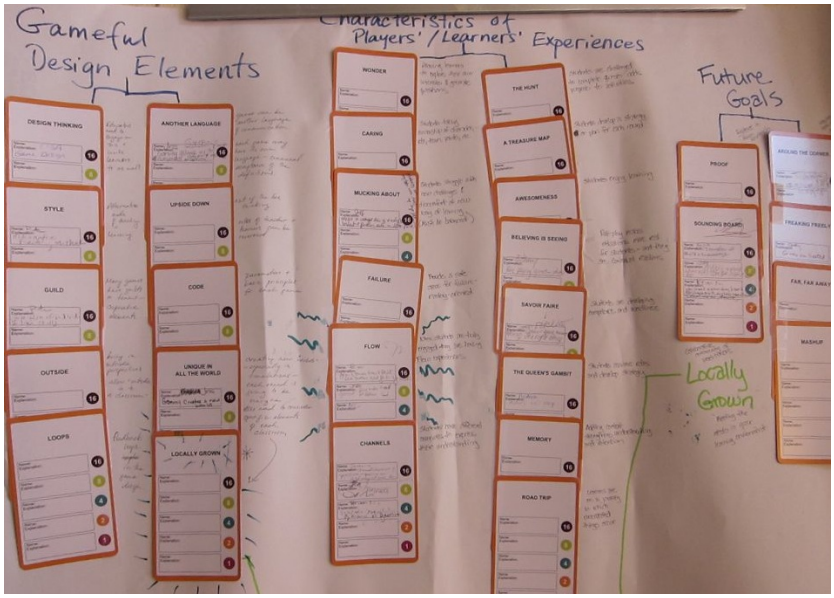
Quests and tasks amplified student-centered experiences. Students shared information and distributed tasks, kingdoms worked through activities at their own pace, and failure to demonstrate mastery resulted in feedback and time for revisions before leveling up. I circulated during class, providing guidance and individual help only as needed, and relied upon formative assessments to identify areas for future support. Teaching this way required giving up my control. I challenged students to solve problems creatively and persevere through frustration. This paid off and they became stakeholders in their own learning.

Cheat #4: Students are co-designers. My students recently presented Kingdom Quest at a technology conference. After visiting other presentations, one student reported: "They're all just showing tools like Edmodo and iPads. Nobody else is really doing anything new and different. Nobody is creating their own thing like we are". Creating our "own thing" was not easy. My students were not a beta test group, and it was impossible to develop a perfect version before implementation. I cultivated trust with my students and remained flexible during our learning. When something did not work well I involved my students as co-designers, described evidence of failure, crowd-sourced the problem to generate student solutions, and then acted. I never stuck with a broken system. Students as co-designers became stakeholders in their learning and gained valuable knowledge about prototyping and fast failure. My students learned that successes and mistakes were opportunities for deeper learning.

4.3 POST Cards

Our final case adapts a card game created by the students and faculty of our educational technology graduate program. Sponsored by Microsoft Research, POST (Project Oriented Semantic Trading) Cards feature two card types – Theme and Task – which players (i.e. students, faculty) trade during game-based project development and technology design (Figure 4).

Figure 4 POST Cards play representation



In this dialogue a teacher educator and her former graduate student "modded" POST Cards. They "traded" three sets of theme cards over email to complete the task "Create a Dialogue" about experiences teaching and learning in our educational technology graduate program. Emails were transposed into a shared online document (Table 2).

Table 2 POST Cards task to "create a dialogue"

Round	*Teacher educator (Dorfman)*	*Graduate student (MacKay)*
1	Theme: Verifiable. The [program's] research seminar was an exploration of what counts as "verifiable". My goals were to introduce methods of educational research, to help people use these methods to study their own projects, and to adopt them in their practices to make "verifiable" decisions on the basis of valid, reliable data. I wanted you to investigate measurement and measurement concepts; to break down rigid ideas of subjectivity and objectivity; and to encourage process over product orientation. In our program,	Theme: The Other Side of the Wall. I'm not sure the "wall" could be considered "verifiable" – the boundaries were fuzzy…and they still are. What did you want us to learn? As a student, I was encouraged to explore the boundaries of my knowledge and was encouraged to find answers (and mostly more questions) in the practice of our work together no matter what role we found ourselves in. Your seminar provided us with the ability to look at research, and the practice of research, as a reflective process of discovery rather than a road map for determining

	discourse was rather informal. The blurriness in roles was a result of the informality and consequence of the faculty being learners too. Although what students and faculty were learning was different, we wanted to be out on the edge of our knowledge, and let students know that we were.	verifiable answers to our questions.
2	Theme: Mastering a Craft. Practice – the more you do something intentionally, while reflecting for improvement, the more improvement results. We got you working to try ideas and see where they took you, knowing that you'd get better as you did. Whatever the 'it' was: designing games, websites, projects, videos, elevator speeches, etc., we knew there would be iterations and they would prepare you for your life work, not be your life's work.	Theme: Worthy of My Attention Now. A significant aspect of the program as a whole were the multitude of opportunities presented to "master our craft" as lifelong learners and teachers. It's true; no matter what we did it was worthy of our attention at the time (we had games to play, puzzles to build, new and old ideas to explore), and it's still worthy of our attention now. Perhaps we don't have a defined structure for our practice as we have graduated and returned to our life's work, but the foundation laid in the program gives me the sense that no matter what I am working on today it is worthy of my attention. There is a feeling of exploration. While the continual iterations may not have defined outcomes, or a defined "play space", the practice of our craft in whatever form it takes, and no matter the failure or success, is one that demands respect.
3	Theme: Glorious Junk. In early childhood education this refers to presenting found materials to children (e.g. Haas, 1996; Topal & Gandini, 1999), for exploration and creation, focusing on process. In our program this involved the Spaghetti Challenge, a game that introduced courses like my research seminar, the videos you made and games you designed and played. When learning tasks are structured as open-ended, they are likely to exhibit characteristics of play: intrinsic motivation, free choice, non-literality, process orientation, and positive affect (Johnson, Christie, & Wardle, 2005). Teaching playfully is deeply engaging. Due to the connection between emotion and cognition, and association with positive emotions, the learning is likely to be more relevant and meaningful to the learner, committed to long-term memory, and to promote creativity.	Theme: Flow. I can't respond without thinking about Csikszentmihalyi (1990) – we certainly found ourselves in situations where challenging assignments were given to us for exploration, and that gently nudged us out of our comfort zones and into a state of flow. And all the while we were both creating and participating in some terribly glorious junk. We redesigned daily activities, created trees out of branches, made graffiti posters, designed and played games in our playful/gameful learning environment. It was all a grand experiment and fostered a community where the focus was on intrinsic motivation, free choice learning (and teaching), and process versus product investigation. I was deeply and creatively engaged in discovering my own flow individually, and as part of the greater learning community.

5 Discussion

These cases provide varied portrayals of gameful learning as one approach to game-based learning. Gameful learning emerges as a descriptive framework to better understand teaching and learning with games, and was not utilized to inform game or study design. This cross-case analysis considers how each gameful learning element relates to game-based learning concerns, including applications to future research. Furthermore, this discussion examines how gameful

learning may promote, and help educators and researchers to better understand, improvisational approaches to teaching, learning, and game design.

5.1 Agency and social necessity

Gameful learning focuses attention on how attitude supports learning beyond the immediate time and space of game play. As noted, challenges persist to demonstrating game play benefits: "The inconclusive nature of game-based learning research seems to only hint at the value of games as educational tools" (Young et al., 2012, p. 80). Consistent with Mazur's (2009) observation that "it is not the technology but the pedagogy that matters" (p. 51), Young and colleagues (2012) recommend "examining how gaming combined with instructional facilitation by a master teacher affects engagement, student behavior, and overall academic achievement" (p. 83). Like musical improvisation that fosters agency and social necessity through shared experience, the gameful attitudes of Saunders, Pratt, and Dorfman are apparent in their instructional decision-making. As Dorfman notes, "Teaching playfully is deeply engaging"; for teachers in each case, intentional experimentation with units, wikis, even graduate programming evidences a broader transformational commitment to playful teaching.

These cases suggest teachers are motivated to experiment with the structure and facilitation of learning environments within their control, and that this includes the design and use of games for learning. By focusing upon the lusory attitude of play, gameful learning is a useful construct for future research attempting to illuminate the qualities of teachers' game facilitation motives as phenomena distinct from game characteristics (i.e. mechanics like points). In spite of constraints associated with a "grammar of schooling" (Tyack & Cuban, 1995), and in contrast to the explicit reward structures of gamification, gameful learning indicates that teachers' individual agency created cohabited spaces for improvisation within and beyond the classroom. Having described such teaching and learning, we advocate design-based research utilizing gameful learning as a construct to map the cohabited spaces of teachers' improvisational teaching-as-play within other disciplines, gaming environments, and settings.

The gameful learning framework also recasts lusory attitude not only as a means for game play, but also as the impetus for teacher improvisations with instructional methods and designs. For Saunders, direct teaching methods (i.e. lecturing) were discarded in favor of "artificial" constraints like guild cooperation and learning via "multiple false starts". Classroom interactions became improvisational: "A bubbling cauldron of exploration, collaboration, and engagement". While Pratt designed Kingdom Quest so that players earned points "to unlock additional powers and perils", more importantly, "It was enjoyment of the game and dedication to teammates that motivated students – not the points". The influence of social necessity inspired by Pratt's instructional facilitation resulted in one student using online tools to transcend the spatial constraints of school: "It's so much fun I even complete quests online when I'm absent to make sure I'm not letting down my kingdom". In an era in which many educators report feeling stifled by curricular requirements, Saunders' and Pratt's attitudes are encouraging alternatives. Their "redesign" of curricula and method emerged from an attitude of professional agency that celebrated experimentation with digital and analog tools, instantiations of their teaching personas, and the social environments of their classrooms.

5.2 Becoming a game designer

Gameful learning helps to explain how teachers and students experimented with multiple real-world and virtual identities. Creating contexts for learning in new and unfamiliar ways required building something to be someone. Becoming Creepor the Emissary and the Fantastical Empress Prattina, in person and online, demanded abandoning classroom habits that were "painful and boring". Discovering new teaching and learning methods required Pratt to "recast myself as facilitator and co-learner". So too did students embrace new selves and social relations. By stepping "outside their everyday selves", the virtual and fictional informed real-world discovery; students were "motivated by the hands-on nature of the science labs", others became co-designers and "stakeholders in their own learning". Identity play occurred within trusting and flexible – or cohabited and improvisational – settings. With lowered stakes, "Finding pleasure in mystery, and learning to cultivate doubt" (Firestein, 2012, p. 17) became the shared and embodied personal qualities of teachers and students.

Encouraging such improvisational risk-taking increased the potential for unknown outcomes, the creation of knowledge, and the establishment of new identities. Gameful learning at the graduate level, for instance, caused "blurriness in roles" and experiences where "boundaries were fuzzy". Yet perhaps it was because of blurred identities – in Saunders' case, the science teacher as space alien – that conditions were created to develop new knowledge about science, world history, or educational technology, as well as self-knowledge about "current and potential capacities" (Gee, 2007). In all cases, teachers' developing self-knowledge is a promising indicator of how gameful learning can describe the improvisational possibilities of learning design. To support future research, gameful learning should frame comparisons among real-world and virtual identities that teachers employ when implementing game-based learning.

Complementing the fictional characters featured in our cases, game designer was one real-world identity embraced by both teachers and students. Teachers easily download video games online (Shuler, 2009) and "integrate" commercial games into classrooms (e.g. Charsky & Mims, 2008). Yet our cases demonstrate how becoming a designer, rather than early adopter or advocate, was a core feature of teacher and student identity. Students' design "literacies" (Lankshear & Knobel, 2009) were evident in their identity as experienced creators. One of Pratt's students remarked, while attending an educator technology conference, "They're all just showing tools like Edmodo and iPads. Nobody else is really doing anything new and different. Nobody is creating their own thing like we are".

For teachers, our cases suggest that the framework of gameful learning describes their "current and potential capacities" as game designers. Across cases, teachers embodied varied design selves – from space alien, to game director, to playful graduate advisor – illustrating Squire's (2011) observation: "The most transformative learning occurred for those teachers who designed their own games" (p. 211). Gameful learning may help advance teachers' new intellectual capacities – though not with "gamified" prescriptions, but rather through emergent improvisational collaborations. By naming how new identities, curricula, pedagogy, wikis, and other tools were created, gameful learning extends Peppler and Kafai's (2010) assertion toward the realm of teacher learning: "To be a full member in today's participatory culture should mean much more than knowing how to play videogames; it should also mean knowing how to create one" (p. 23). In what ways might educators become "full members" of their professional communities as game designers? Inquiry utilizing gameful learning can identify how teachers design both the tools and the selves supportive of game-based learning.

5.3 Embracing ignorance for learning

Embracing ignorance – as well as curiosity and experimentation – is a stance characteristic of scientists. These cases suggest teachers and students should also embrace ignorance as they play, question, and "mess around" with media, meaning, and knowledge (Ito, 2010). Our cases indicate game design and play became means for building "a social reality and a culture of improvisation" (Odria, 2011, p. 56) with unknown outcomes; that is, building learning that looked toward "glimpses" of ignorance that eventually became measures of intellect. How was the cultivation of ignorance featured as prominently as the accumulation of knowledge?

Across cases, the acceptance of game constraints helped students engage and express ignorance routinely. The structure of Kingdom Quest supported student-to-student inquiry, as they "moved up the feudal hierarchy with their questions". Receiving answers was an invitation to further investigate what they did not know. In Matter Quest, "Once mastery was demonstrated each guild received a password to the next wiki level". Each game did not present content knowledge as an end but a means for continued discovery: "To uncover, to remove a veil that was hiding something already there, to reveal a fact" (Firestein, 2012, p. 20). The graduate education case also exhibited ignorance complementing knowledge. Just as students were "encouraged to explore the boundaries of... knowledge", faculty also "wanted to be out on the edge of our knowledge, and let students know that we were". Across settings, ignorance was catalyst and consequence; not knowing was necessary for the intellectual work of learning.

It is necessary to recognize that embracing ignorance to promote student and teacher learning requires considerable prior knowledge. The teachers featured in our cases were not novices. Like skillful improvisers investing countless hours of practice, rehearsing standard methods, and building strong social connections among community members, these veteran educators had extensive experience and knowledge of instructional practice. This familiarity afforded innovative technology designs and social arrangements. Gameful learning may be a useful construct for other educators and researchers who are interested in describing the ways in which teachers' improvisations act in service of game-based teaching and learning.

6 Conclusion

As noted, we anticipate other researchers adapting and refining gameful learning as a design framework for future game-based learning inquiry. To guide such efforts, and to further expand possible "cohabited spaces for embodied collective learning", we conclude with a dual agenda for improvisational approaches to game-based learning: support collaborative game design, and honor teachers' current and potential intellectual capacities.

Lest our cases read as explicit endorsements for increased game play, we are not arguing that teachers and students should only play games. In the spirit of Salen (2008) – that "play is iterative as is good learning... gaming is a practice rooted in reflection in action" (p. 14) – our cases are evidence supporting the "gamefulness" of designing games for learning. We consider gameful learning a framework to guide Squire's (2011) assertion: "Game-based learning pedagogies require dedication to design as a worthy goal of education" (p. 59). Recall teaching and learning within Kingdom Quest: "When something did not work well I involved my students as co-designers, described evidence of failure, crowd-sourced the problem to generate student solutions, and then acted". Improvisations do not occur in isolation, and gameful learning may only arise because of students as co-designers.

While our analysis focused largely upon teachers as game designers, students in all cases were collaborators, or co-designers. Elementary, secondary, and graduate students were co-designers of technology, inquiry-driven learning, and the social structures that mediated game play. Just as students have been supported as game designers in settings outside the classroom (e.g. Peppler & Kafai, 2010), we believe attending to gameful learning elements can help to scaffold collaborative co-design processes between students and their teachers. In doing so, the "answers" of pre-determined learning goals may become blurred; indeed, like Mathews' (2010) game design curriculum that cultivated "a culture of experimentation and critique", the problems of learning may become generative opportunities for community solutions.

Gameful learning is also a means for perceiving how educators are creative professionals capable of being held to high expectations for generative intellectual work (and not just technical skill at curriculum delivery). Though educators often push against the adoption of particular standards or tools, gameful learning can help researchers to reveal how teachers adapt – and actively design – curricula and tools that emphasize higher-order thinking skills, broad areas of knowledge, and process-oriented activity. Finally, with research about games and learning maturing, gameful learning turns attention to that which makes games and play serious intellectual work for teachers and their students – choice and perseverance, nonlinearity, design structuring engagement. To cultivate higher quality ignorance about these and other qualities, we are convinced that gameful approaches to learning and improvisational representations of research are enjoyable and useful ways of being.

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