Integrating Game-Based Learning Initiative: Increasing the Usage of Game-Based Learning Within K-12 Classrooms Through Professional Learning Groups

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Abstract

In the past fifteen to twenty years there has been an increased interest in the use of games for learning. A considerable amount of work has already been done by educational researchers and theorists (Gee, Squire, Malone, Lepper, Shaffer, etc.) to identify and to operationalize the native affordances of games that make them good for learning. Unfortunately this has not led to widespread adoption of game-based learning in the classroom. The root cause for this is the paucity of professional development opportunities centered on the proper integration of games within the curriculum. This article will discuss why professional development is the proper avenue for increasing the integration of games aligned with desired outcomes, what a game-based learning professional development curriculum should look like, and report on an ongoing game-based learning professional development opportunity.

Game-Based Learning in the Classroom

"Play refers to those activities, which are accompanied by a state of comparative pleasure, exhilaration, power, and the feeling of self-initiative" (Gilmore, 1971, 311). This quote fully encapsulates the motivating factor behind the recent increase in those who study the use of game-based learning. For the purposes of this paper, game-based learning is defined as "activities that have a game at their core, either as the main activity or as a stimulus for other related activities, and have learning as a desired or incidental outcome" (Kirriemuir & McFarlane, 2004, p. 7). This definition is important as it allows for the use of digital and/or analog games, as long as learning of some kind is the intended outcome.

Members of the Game-Based Learning (GBL) community point to the native affordances of games as a more engaging and motivating alternative to traditional learning environments (Amory, Naicker, Vincent, Adams & McNaught, 1999; Engenfeldt-Nielsen, 2006; Gee, 2005; etc). Some of the characteristics of games which are synonymous with the ideal conditions for learning are that games are active, system rule-based, contextually situated, and engaging (Bransford, Brown, & Cocking, 2000; Bruner, 1961; Quinn, 2005; Vygotsky, 1978). Furthermore, games are excellent learning environments because they are "interactive, provide ongoing feedback, grab and sustain attention, and have appropriate and adaptive levels of challenge" (Shute & Ke, 2012, pg. 1).

Based on this information, one would wonder why games are not used more widely in classrooms. There are several possible contributors to the lack of adoption of GBL within formal learning environments: inconsistent empirical evidence, time constraints, limited resources, stigma associated with "play", methodological flaws in empirical studies on games, and the lack of evidence-based best practices for the integration of games within the classroom (Hays, 2005; Kebritchi, Hirumi, & Bai, 2010; Shute, Rieber, & Van Eck, 2011; Van Eck, 2006). While all of these factors play a role, the absence of pre-service and in-service professional development opportunities centered on GBL is the biggest contributor to the lack of widespread integration of games in the classroom (Becker, 2007). In other words, teachers need assistance in developing the technological, pedagogical, and content knowledge needed to effectively use games for learning. Without this knowledge, teachers will not attempt to implement GBL until they "are confident in their ability to use games effectively to enhance learning" (Becker, 2007, p. 478).

At this time, colleges of education might not offer courses specifically focused on GBL for pre-service teachers. While there has been a concerted effort within most, if not all, teacher

preparation programs to provide technology integration courses, these courses tend to be general in scope. This is for a good reason, as undergraduate technology integration courses should be designed to provide pre-service teachers with an overview of technology's role in learning. While pre-service teachers should be familiar with the potential learning benefits of games, it would be best to target instruction on GBL to in-service teachers who are seeking professional development opportunities.

The idea of targeting in-service teachers for GBL professional development offerings is driven by the recent research conducted on how some teachers are already implementing some form of GBL. A nationwide survey of in-service teachers, found that there is immense interest in GBL (Takeuchi & Vaala, 2014). This survey, one of the most comprehensive surveys on the use of games in the classroom, has arguably the largest sample sizes of any survey conducted on this topic. Of the 694 K-8 teachers surveyed nationwide, 74% make use of digital games for instructional purposes, with 55% of those teachers using games on a weekly basis. When asked their thoughts on using digital games, teachers who did not use games pointed to their uncertainty on how to properly integrate games in the classroom as the most significant impediment. The majority of teachers who do use digital games (80%) also agreed that integration was challenging, especially because of the difficulty in finding games aligned directly to the curriculum.

A similar nationwide survey was also conducted in 2013 to determine the role that games have in the classroom (Fishman, Riconscente, Snider, Tsai, & Plass, 2014). The survey asked 488 teachers questions in order to determine how often games were used, what they used games for, and most importantly, what barriers hindered them from using games in the classroom. In relation to barriers they faced when implementing games in the classroom, 48% of the teachers

cited the inability to find quality games. Additional barriers mentioned were difficulties in finding games that fit into the curriculum (47%), being unsure as to how to integrate games into the instruction (33%), and unfamiliarity with the technology (26%).

When it comes to professional development, only 17% of the game-using teachers first learned about using games in the classroom from professional development. Most game-using teachers learned about using games from another teacher/coach/supervisor (33%) or were self-taught (23%). When asked for how they supported their professional learning once they began using games in the classroom, 68% of the game-using teachers responded that they looked to other teachers within their district or through online discussions with other educators (25%) (Takeuchi & Vaala, 2014).

The findings and insights from these two nationwide surveys point to barriers to the implementation of GBL that could easily be addressed by offering professional development training for in-service teachers on how to integrate games within their teaching. In the next two sections we will discuss general practices of quality professional development and how these best practices were applied using an example of a GBL professional development offering.

Professional Development Best Practices

So what should professional development opportunities for teachers in the area of GBL look like? The research literature in professional development is in agreement that effective professional development, that results in a change in teaching practice, and have an effect on student achievement, should have the following characteristics (Garet, Porter, Desimone, Birman, & Koom, 2001; Penuel, Fishman, Yamaguchi, & Gallagher, 2007):

1. It is sustained and intensive

2. If should focus on an a specific academic content area
3. It should be active
4. There must be coherence between training and the daily activities of the teacher

Professional development that is too short in duration is a common complaint of teachers (Penuel, et al., 2007). Professional development that is not of the one-off workshop type, but of the type that incorporates multiple sessions, in-class implementations of knowledge and skills learned, and the opportunity for participants to think critically about what they have learned and experienced, is more likely to have a positive impact on teacher practice (Penuel, et al., 2007).

Focusing on specific content area within professional development offerings has many impactful benefits. One benefit is in the area of collaboration (Garet et al., 2001). “Collective participations of groups of teachers from the same school, department, or grade level as opposed to the participation of individual teachers from many schools” (Desimone, et al., 2002) has been shown to be an important structural element of impactful professional development. This is powerful, as collaboration has consistently demonstrated its ability to function as an impetus to change in teacher practice (Anderson & Helms, 2001; Supovitz & Turner, 2000). Having teachers within the same subject area participate in sustained professional development allows everyone to speak the same language. Also, teachers within the same content area will bring similar experiences with them, which will allow for conversations to take place where they can share and compare best practices. Another benefit of focusing on a specific subject area is that it provides the conditions necessary for a combined focus on content knowledge and knowledge of teaching strategies.

Active learning is not just good for students. It is also important for teachers seeking to improve their practice. Just as teachers are encouraged to design instructional activities that

allow for learners to construct their own knowledge, teachers need opportunities "to become actively engaged in the meaningful analysis of teaching and learning, for example by reviewing student work or obtaining feedback on their teaching" (Desimone et al., p. 83). Therefore, professional development offerings should have as an integral component "time for instructional planning, discussion, and consideration of underlying principles of curriculum" (Penuel, et. al, 2007).

There must be a clear, direct connection between what is being taught during professional development sessions and what happens in the classroom. Professional development that takes place in isolation from the day-to-day activities of teachers has very rarely been found to have an impact on learning outcomes and teacher practice (Zigarmi, Betz, & Jennings, 1997). Teachers need authentic activities that are connected to state and national standards as well (NRC, 1999; Hawley & Valli, 1999).

IGBLI: A Practical Example

Based on the best practices for professional development discussed earlier, the University of Alabama/West Alabama Regional Teacher In-Service Center has recently created a professional learning group (PLG) to serve as a test bed. For the purposes of this article a PLG is defined as a sustained professional development offering centered on teachers working individually and collaboratively on improving their teaching practice, in an attempt to improve learning outcomes. The PLG, called **I**ntegrating **G**ame-**B**ased **L**earning **I**nitiative (IGBLI), purposes to increase the proper integration of game-based learning within the classroom.

To accomplish this, existing professional development resources of the Technology in Motion program, housed at the in-service center were leveraged to form this PLG. Secondary teachers throughout the region that the in-service center services were recruited to participate

through the in-service center's mailing list and by contacting professional development coordinators throughout the region that the center services. All teachers who wanted to participate in the PLG had to submit an application to be included in the PLG, and if accepted had to agree to attend four sessions throughout the school year and to have at least one in-school observation session as well. No incentive was provided for participation. Applications were evaluated on whether the teacher taught a core subject on the secondary level (English, math, science, or social studies), and if they made a compelling argument for their inclusion into the PLG in essay form. The initial cohort was made up of fifteen in-service teachers (13 females and 2 males) working in the West Alabama region. The initial cohort had two English/language arts teachers, five science teachers, six social studies teachers, and two math teachers, all with varying years of teaching experience.

IGBLI Curriculum

IGBLI's curriculum was designed to provide participating teachers with the necessary knowledge and skills to not just use commercial-off-the-shelf digital games in the classroom, but to design their own analog games, and teach their students how to design games as well. A main concern when designing the IGBLI curriculum was to present GBL as more than just digital games. Many schools do not have access to the technology necessary to implement digital GBL, so a concerted effort was placed on the use, design, and development of analog games in sessions 2 and 3. The four sessions covered the following topics:

1. Repurposing commercial-off-the-shelf games for learning
2. Teacher as the game designer: Part 1
3. Teacher as the game designer: Part 2
4. Learner as the game designer

Session 1 - Repurposing commercial-off-the-shelf games for learning: The first session served multiple purposes. First, it provided participants with a survey of games in general. This survey of games consisted of a discussion of definition of games and identification of game genres. From there, a brief presentation was made on the theory supporting game-based learning, which included, but was not limited to, information on matching game genre to potential learning applications, connecting learning domains to the cognitive strategies employed in games, and problem types commonly found in digital games. The majority of the initial session was spent on the proper steps for locating, evaluating/selecting, and integrating digital games not specifically purposed for education into the classroom. Participants were then divided into groups in which they were tasked to locate a commercial, non-educational game, map the game to state and/or national standards, and develop a lesson around the game. From this within-session assignment, teachers were asked to complete the same task on their own in between the first and second session, and trying the lesson within their classrooms.

Sessions 2 and 3 – Teacher as game designer: The second and third sessions focused on teaching educational game design. As stated earlier the focus during these sessions was on the use, design, and development of analog games. Many of the teachers within IGBLI teach at rural schools where technology is either not readily available, outdated, or nonexistent. We did not want to make technology a hindrance to implementation of GBL, hence the focus on analog games. To provide teachers with the skills needed to design games for learning, they were first instructed on the parts of a game and then guided through four different exercises. These exercises were modified from the Institute of Play's GBL design handbook. First, teachers worked in groups based on their content areas, in which they chose their favorite game and analyzed the game to determine the goal, challenge, core mechanics, components, rules, and play

space. From that, they transitioned to the next exercise, in which they modified their favorite game. Each group was given one part of the game to modify. They were then required to play-test their modified version of the game using the members of another group. For example, one group modified the classic card game Go Fish by changing the rules of the game to collect not pairs, but three of a kind. Then the teachers worked on identifying a concept and standard or objective within their content area and designing an analog game around it. Once again, each group's game was play-tested using the members of another group. In between the second and third session, each individual teacher was then tasked with taking the game he or she created and play-testing it with his or her students. The IGBLI staff went to observe and assist in the in-school play-testing session. During the third session, the feedback received from play-testing sessions was discussed between group members and then used to complete the final iteration of the game. In addition to completing the game created during the second session, the teachers repeated the process of developing an analog educational game and play-testing said game. Sessions two and three are important in terms of GBL, as they helped teachers realize game design is an iterative, collaborative, and intentional process, honed with practice over time. These two sessions also provided teachers with an alternative to the time consuming process of repurposing commercial digital games for learning purposes and creating learning activities that are tightly aligned with state and/or national standards.

One of the games created during these sessions is entitled Periodic Rummy. This is a card game based on the popular game of gin rummy, where the goal of the game is to be the first person to have a pair, three of a kind, and a run of cards that share characteristics of elements on the periodic table. Players receive points for the combination of cards they play, and the first player to get to one hundred points wins the game. The spark that fueled the design of this game

was an issue two science teachers were having with helping teach the periodic table. Specifically the game would assist in the identification of chemical elements, atomic numbers of elements, electron configurations, family name, and additional characteristics (highly reactive, S Block, etc.). The deck of cards would have a variety of letters, symbols and characteristics. For example the chemical element helium, would have a variety of cards that would represent it:

1. Helium
2. The number “2”
3. Non-flammable
4. Noble Gas

This game is in the process of being play-tested with secondary students at the writing of this paper, but it stills serves as a good example of the work that teachers are involved in when designing a game. The major focus of this round of play-testing is making sure the game rules allow for a seamless playing experience, whether players find the game enjoyable, and refining the number of cards in the deck and the what characteristics of the chemical elements will be in the final deck of cards. The feedback from the play-testing sessions will be used to refine the game, and then the next play-testing sessions would focus on the impact playing the game has on student learning. Below you will find the game design notes the teachers made for Periodic Rummy.

INSERT FIGURE 1 HERE

Figure 1: Periodic Rummy Parts of a Game Template

INSERT FIGURE 2 HERE

Figure 2: Periodic Rummy Rules

The intent of the team of teachers designing this game is to use Periodic Rummy as a co-instructional game initially and then as a post-instructional game. When used as a co-instructional, the teachers would use add cards to the game deck as they covered each element within the periodic table. Once all elements have been covered, then the game would be used as a review for an exam or any assessment related to the periodic table.

Session 4 – Learner as game designer: The fourth session focuses on having the teachers take what they have learned about game design and teach the process to their students. Having learners go through the game design process requires them to think critically about the concepts that are being taught and provides them an opportunity to construct their own knowledge (Van Eck, 2006). This, along with the ability of games to serve as an ideal environment to facilitate systems thinking, makes having students participate in game design a powerful tool for learning (Kafai & Resnick, 1996). This rationale is based on Kafai (1996), who divides approaches to educational game design into two perspectives: Instructionist and constructivist. Within the instructivist educational game design perspective, all major decision about the game (graphics, the educational content, genre, narrative, etc.) are made without input from the end user (the learner). As Kafai states, “the game player is not partial to the discussions involved in developing valid instructional game ideas, designs, and strategies. What finds its way

into the final designs is only a substrate of those discussions" (Kafai, 1996, p. 39). Kafai supports the constructionist approach to game-based learning as it involves the learner within all game design decisions. "Rather than embedding "lessons" directly in games, their goal has been to provide students with greater opportunities to construct their own games—and to construct new relationships with knowledge in the process" (Kafai, 1996, p. 38).

Out of all the four sessions, the last session is the topic that has the potential to have the most impact. There are already many promising examples of the power of teaching learners how to design their own games. Two prominent examples are the work being done with the SCRATCH programming language, and the Quest to Learn schools. SCRATCH is a visual programming language created by Lifelong Kindergarten Group at the Massachusetts Institute of Technology that allows for the creation of games, animations, and interactive stories through the use of an online development engine. Scratch has been shown to be impactful in introducing young learners to the world of programming (Forsgren, et al., 2014), support technology integration in mathematics (Choi, Jung, & Baek, 2013), sparking creativity (Koh, 2013), as a tool of collaborative practice (Dasgupta, 2013), and a tool for teaching and assessing computational thinking (Dasgupta, 2012).

Another successful implementation of constructivist approach to game design is Quest to Learn. Quest to Learn is a public school located in New York whose curriculum was designed by teachers and game designers. In its own words "Quest to Learn re-imagines school as one node in an ecology of learning that extends beyond the four walls of an institution and engages kids in ways that are exciting, empowering and culturally relevant" (We are re-imagining institutions, n.d.). In addition to teaching through analog game design and development, there are elements of game design evident throughout the curriculum as students work on projects framed as games or

quests, which increase in difficulty throughout the school year, and require them to work as teams of designers to complete these tasks. In addition to the curriculum offerings, Quest to Learn also has a design studio, after-school game design club, a social network for students, and a mixed-reality learning environment. This model has also been replicated in Chicago (ChicagoQuest) and research is being conducted to determine the impact of this approach on achievement and the acquisition of 21st Century Skills such as systems thinking, creative problem-solving, collaboration, time management and identity formation.

Future Directions: Maintaining and Expanding IGBLI

Once this initial year of IGBLI has been completed, the goal is to maintain the current group and recruit additional teachers from within the West Alabama region. The next iteration of IGBLI will be refined based on the feedback collected at the end of each session, and from one-on-one interviews conducted with teachers at the end of the school year. A major area of focus for the second year of IGBLI is to create a cohort specifically for secondary mathematics teachers. This would allow for focused attention on the creation of games that cover the major areas in the Alabama course of study (along with Common Core), by grade (6-12) and topic (algebra, geometry, trigonometry, precalculus, etc.)

Focusing on secondary mathematics as a content area during the next phase of the PLG will provide a means for investigating how games can be used to address many of the issues prevalent in mathematics education. For example, games have been shown to improve basic skills, conceptual understanding, engagement, and motivation, which are all important to math educators. Additionally, games provide an instructional tool for situating mathematics within an immersive environment, which can in some ways mimic ‘real-world’ settings. This is important as games allow for students not to just know math, but do math. New findings from this project

will help to inform curricula built around the use of games in secondary math and evaluate its effect on learning outcomes.

This next phase of IGBLI will also contribute to a database of games and game-based lesson plans that can be used to cover the entire scope and sequence of secondary mathematics within the state. Additionally in the second year our intent is to conduct case-study research, and begin the process of collecting data on the impact of game-based learning on student achievement, engagement, motivation, change in teacher practice, and 21st century skills (creativity, collaboration, communication, critical thinking, problem solving, systems thinking, etc). Our desire is to create a growing community of practice that spreads throughout the state and then throughout the country.

Conclusion

This work is important for several reasons. The most important is it will help advance the use of game-based learning in formal settings. The educational research community has largely embraced the pedagogical benefits of game-based learning. Unfortunately there is a considerable gap within in the field when it comes to determining the contexts and conditions needed to equip teachers with the pedagogical, content, and technical knowledge necessary to effectively integrate games within their teaching practice. This work will help to address that gap and help to strengthen our understanding of how games help people to learn.

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