The Teacher Evaluation Game: Using Video-game Technologies to Understand and Teach Complex Practices

Proposal Narrative

1.0 Clear statement of central research question

We seek support to build a web-based Instructional Leadership video game-based learning environment for training K-12 school teachers and leaders in teacher evalaution. It has been well established in educational research that where you find good schools, you find good leaders (Leithwood, et.al. 2005; Hallinger and Heck 1999). But the ability to train leaders for improving instruction in schools has proven an inexact, slippery process (Levine, 2005). In this proposal, we argue that the advent of real time strategy and role-playing video games can create dynamic learning environments for creating, testing and using practical theories of action (see Shaffer et.al, 2005; Castronova, 2005). The capacity to contextualize the practice of school leadership through video games fills a large void in training school leaders to become successful practitioners. We propose to create a web-based video-game that will help leaders develop, adapt and test practical theories for identifying and supporting classroom teaching practice. Our research questions address the two emphases of the game development process: *knowledge generation* and *learning assessment*:

1) How can the design of video game-based learning environments generate new practical knowledge about developing the organizational conditions for improving student learning?

2) What do novice and veteran school leaders learn from engaging with video game-based learning environments for teacher evaluation?

This Spencer proposal is intended to support a three-year project to develop a sustainable, testable web-based video game about teacher evaluation practices. Rather than address the entire scope of school leadership practices, this proposal focuses on a specific subset of practices, teacher evaluation, in order to develop a prototype for developing and deploying larger-scale games for school leadership. Our Teacher Evaluation Game (TEG) will use recent advances in video game design and school leadership theory and practice to construct powerful tools to help leaders learn research-based evaluation practices. We chose teacher evaluation both because of its centrality to the reform process in schools, and because of the political and cultural obstacles schools face in effectively using evaluation. The TEG will begin as players review a video of classroom teaching practice. Players will select pieces of the video as evidence for a research-based evaluation framework, and if desired, will use in-game tutorials to learn more about the standards that guide evaluation. After assembling a video-based record of evidence, players will compare their ratings with in-game experts. These artificially intelligent experts will be constructed to anticipate evaluation problems and to highlight learning opportunities for players. Players will have a chance to revise their evaluation according to expert feedback and will devise a professional learning plan and discuss it with the teacher represented in the video case. An interdisciplinary design team will engage in an iterative cycle between ethnographic research, prototype assembly, and formative and summative assessment with a variety of novice and experienced evaluators in order to produce a playable evaluation game.

2.0 *Review of relevant literature*

Video game design and deployment represents a unique opportunity for combining research *on* practice and research *for* practice (Shrader, et. al. 2001). Here we review the research on how video game design extends the tradition of simulations to test and produce social and organizational knowledge (research *on* practice), then discuss how video game play can fill a critical gap in current professional training programs (research *for* practice). We conclude the review with a consideration of why teacher evaluation practices provide a good starting point for school leadership video game development.

2.1 Video game design as research on *practice*

Video game design stands as the logical successor to a central motive force in late 20th century sciences: the computer simulation. The capacity of the computer to simulate cognitive processes, Howard Gardner (1985) points out, gave rise to the "mind's new science" by allowing researchers to observe new dimensions of cognition and to model complex human processes. The capacity for computers to simulate complex phenomena provided a giant step beyond prior observational or experimental research because researchers could now test predictions about complex systems that could not be directly observed. Constructing simulations also forces designers to "operationalize" theories into a series of interactive rules that are intended to reflect the operation of the actual systems they represent. The performance of the simulation serves to test the initial assumptions built into the model, and, if effective, enables researchers to make predictions about the simulated phenomena.

The design of contemporary video games, such as real-time strategy, role-playing or massively multiplayer games, expands on the power of simulations to generate new paths for social and cognitive research (see, for example, Castronova, 2005; Juul, 2005). Like simulations, such games rely on sophisticated contextual representations to situate user interaction. Commercial games such as *Rise of Nations, Deus Ex* and the *Sims* engage players with complex synthetic worlds that serve as interfaces for interaction with underlying simulation databases. The central difference between simulations and video games is the role of *agency*. Simulations are developed to accurately model phenomena; complex video games emphasize how players forge unique narrative paths through represented environments (Crawford, 1982). In other words, people use simulations as they play video games. This emphasis on agency also forces game designers to build simulations, but from the perspective of the player, rather than from the perspective of modeled phenomena. Consequently, the simulations used in video games are poor vehicles for outcome prediction because game designers "cheat" the accuracy of simulations to make games fun by deliberately suppressing or highlighting environmental features to streamline gameplay (Crawford, 1982).

Video game design does, however, retains the theory testing and development property of simulations. This is particularly relevant when designers tackle games for learning. Games for learning involve two key differences from entertainment game design: 1) incorporation of established theory/practical knowledge, and 2) iterative design. *America's Army* provides the leading example of a professional learning game design. Initially designed as a recruitment tool, Army officials insisted that *America's Army* faithfully reproduce not only the action, but also the ethics and values, of infantry

unit interaction in crisis situations (Davis, et. al, 2003). The designers began with standard operating and training procedures, then developed ethnographies, interviews and user testing to understand how these procedures played out in actual situations. Getting the game "right" required designers to continually revisit their initial assumptions in light of design and subsequent game play. This approach to design involves an iterative cycle between designing, testing, and analyzing the game environment (Zimmerman, 2003). Thus video game design for professional learning constitutes a special form of design research (Collins, 1996; Cobb et. al. 2003). In design experiments, researchers build and deploy interventions, based on research-based assumptions about intended practices, to investigate how complex learning occurs within authentic social settings. In turn, designers develop a deeper understanding of the theories that guided their initial designs (Barab & Squire, 2004)

In this way, game design can serve as a method for teasing out the practical implications of research-based theories. This is hugely important for fields such as educational leadership that are regularly criticized for maintaining a theory-practice gap (see, for example, Levine 2005). The bulk of education leadership research seems to consist of case study descriptions of specific practices, prescriptions for interventions, or evaluations of intervention outcomes. Each of these kinds of knowledge require new (and veteran) practitioners to understand when, and under which circumstances, new ideas can be appropriately deployed. Halverson (2004) describes this capacity to fit ideas to circumstances as a form of *practical wisdom* that evades many current models of educational research. Developing video games for learning will force designers to operationalize assumptions about best practices into a game model, to test models against

the observations and game play of experienced professionals, and to develop new, more nuanced theories of how school leaders actually engage in complex practices such as instructional improvement in schools. This knowledge generation, often simply folded into the design process, can be highlighted as a method for tracking how practical wisdom is expressed in complex learning environments. Thus, just as Howard Gardner and others built computer simulations to research cognition, video game development promises to provide an important new venue for research on practice.

2.2 Video game design as research for *practice*

While video game design promises a new path of research *on* practice, video game play is a form of research *for* practice that addresses a critical gap in professional preparation programs such as school leadership. The traditional menu of classroom learning, seminars and practica served by education leadership programs provide inadequate training for many school leaders (Levine, 2005). Students learn about cases, theories and heuristics in courses and seminars, and learn to navigate specific school environments in practica, but often are unable to make a principled connection between theories and practice. Video games build on a long tradition of tools used by leadership preparation programs to address this gap, from role playing activities, to problem and case-based learning activities (Bridges and Hallinger, 1995; Merseth, 1997) to board games (*Making Change,* 1989) to computer simulations (Hallinger & McCary 1990). Video games such as *School Tycoon, Virtual U* and *In the Center of Things* provide early models for players to practice generic management skills in experimenting with the infrastructural, financial, and personnel systems in K-12 and post-secondary schools.

Video games are dynamic enviroment that allow players to experiment with identities, acquire and navigate complex symbol systems, and engage in many forms of learning by doing (Gee, 2003). Video games provide environments where agents trace narrative paths through rich interactive environments (Murray, 1997). Games allow players to understand how decisions to select different paths through complex environments can compound to yield entirely different gameplay. The immersive qualities of commercial video games move beyond the skill and strategy development of earlier learning simulations to address issues of identity and values (Gee, 2003). In other words, game provide access to what David Shaffer calls *epistemic frames*, the network of strategies, values, goals and beliefs that characterize a profession (Shaffer, in press). Game design that captures the epistemic frame of school leadership, for example, can situating skill development activities in the values and goals of the profession. Introducing players to the nuances of a professional practice means starting with the actual activities of school leadership, such as monitoring teaching and learning, planning, and maintaining a safe learning environment, and showing how successful enactment of these reflects the epistemic frame of the profession.

2.3 Teacher evaluation practices

For the purpose of this grant, we propose to focus our game development project on the practices of teacher evaluation. Reform-based teacher evaluation practices present an interesting challenge for school instructional leaders. While teacher evaluation programs promise the ability to access, monitor and correct teaching practices in context, without clear, legitimate access to how reformed teaching practices play out in classroom teaching, it is very difficult to provide the support necessary to help teachers learn new

practices. Evaluation programs are also important for accountability purposes. Schools

and districts need quality evaluation programs to control staff quality and to provide

grounds for dismissing poor teachers. However, traditions of teacher autonomy and the

traditional separation of summative and formative functions of assessment have

traditionally undermined the potential effects of evaluation (Natreillo, Pallas & McDill,

1990). Teacher assessment has been used to "weed out" poor performing teachers rather

than to hold all teachers accountable or to improve the performance of all teachers

(Darling-Hammond, et al., 1999; Haney, Madaus & Kreitzer, 1987). Consequently, most

current teacher evaluation practices do not provide sufficient training, fail to give

accurate representations of teaching practice and lack the support of teachers and school

leaders (Peterson, 1995; Loup, Garland, Ellett, & Rugutt, 1996). Traditions of teacher-

administrator opposition, coupled with a lack of knowledge and skill about their

evaluation tools, have crippled evaluation practices and left many schools with poor tools

to directly inspect classroom teaching.

Teacher evaluation has experienced a recent standards-based renaissance. More

and more, districts have adopted standards-based teacher evaluation frameworks that

integrate prior research on expert teacher practice, content knowledge, pedagogical

knowledge, classroom management and assessment skills (e.g. Danielson, 1996;

Danielson & McGreal, 2000). Still, school leaders and evaluators must know how to use

evaluation frameworks in the context of typical school and classroom settings. While we

would not argue that evaluation practices can be essentially reduced to how evaluators fit

classroom observation evidence to general observation frameworks, we would suggest

that a lack of knowledge about how to select proper evidence and communicate

effectively with teachers can reduce evaluation from an instructional to a political process (Halverson, Kelley & Kimball, 2003). Research that details the practices evaluators actually use to engage in standards-based evaluation practices (e.g. Halverson & Clifford, in press) demonstrates how evaluators customize rubrics to filter observation data and assemble reports, and shows how leaders use evaluation as a process to build faculty good will rather than critique. Game design will operationalize the practical and theoretical assumptions about teaching built into standards-based evaluation frameworks, and will construct learning environments to guide players through the process of observation, assessment and follow-up conversation that constitute the evaluation cycle. Video-game play will show how to engage in research *for* practice by allowing aspiring school leaders to practice with new identities, strategies and schools in this game-based interactive learning environments for teacher evaluation.

3.0 Detailed description of study's research design

This proposal involves an iterative design process to develop the TEG. In order to give a full sense of the scope of the proposal, this section will provide a brief description of the planned TEG components, then will detail a design research process intended to build, assess and implement the TEG.

3.1 TEG Game Description

The game will proceed through four distinct phases that correspond to a typical teacher evaluation cycle: observation, assessment, expert evaluation and discussion. In the first TEG stage, *observation*, players will learn to select pieces of evidence from a series of carefully edited videos of classroom teaching practice. The game interface will

allow players to code video in terms of an standards-based rating system, and will allow players to practice on the difficult task of identifying evidence appropriate to the evaluation scheme (Figure 1). The interface will also provide access to relevant contextual information, such as lesson plans, student and community information, and prior teacher evaluations.

Figure 1: Proposed TEG Observation Interface

The proposed TEG design includes four cases of teacher classroom practice from across k-12 grades. Each case will involve recruiting a classroom teacher, video-taping several examples of classroom teaching, and conducting reflecting interviews with the teacher concerning her instructional goals and strategies. However, once the templates for development are created, the game should be able to accommodate a wide range of customized classroom examples for specific local uses such as professional development or lesson study.

Figure 2: Proposed TEG Assessment Interface

The TEG second stage, assessment, will incorporate visual reasoning tools for

players to justify their evaluation scores. The central design metaphor will be reasoning

and argument construction tools such as those developed by Inquirium[1] for the Intel

Thinker tools project.[2] In this stage, evaluators consider how the evidence they

highlighted in the observation stage fits into the standards-based evaluation framework.

Users sort and rate evidence, collected as chunks of video sorted into evaluation bins, in

terms of the whether the teacher has or has not demonstrated competence in a particular

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[1] http://www.inquirium.net
[2] http://www.intel.com/education/visualranking/index.htm

evaluation category. As in the first stage, the resulting design template ought to

accommodate a variety of evaluation frameworks for local customization.

The TEG third stage integrates several approaches to evaluation into pre-

constructed "expert" avatars that explain how expert selection of evidence and assembly

that can then be compared with the player's (Figure 3). Building this level of the game
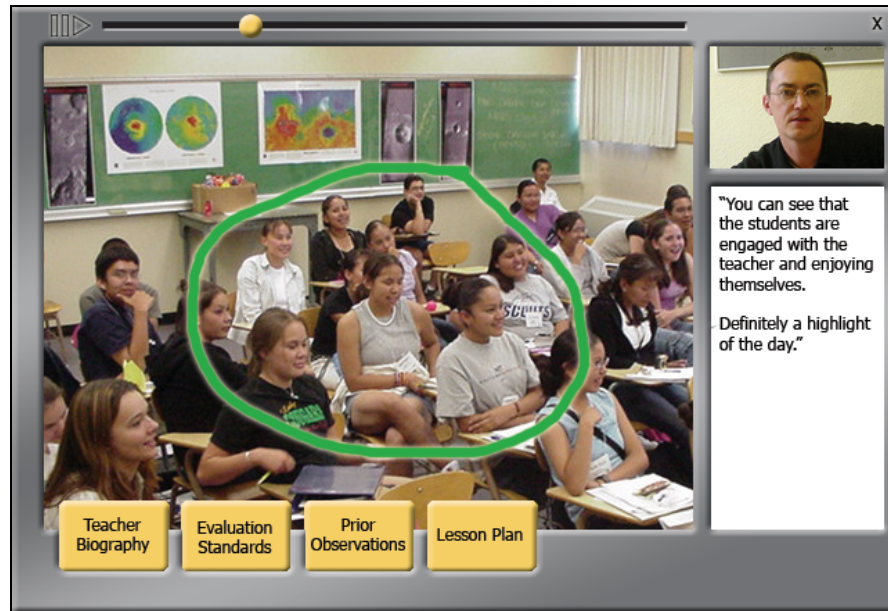
Figure 3: Proposed TEG Expert Feedback Interface

will involve inviting expert evaluators to rate the same videos seen by players,

constructing a system to compare expert and player ratings in terms of evidence selected,

and developing an expert feedback system to generate appropriate video and

documentary feedback. This stage will highlight characteristics of the expert's "eye" for

teaching practices and will provide access to the kinds of skills and knowledge often left

out of evaluation research and training.

Finally, players will use information about the teacher's prior professional record

to discuss the rating results and a professional development plan with the teacher. The

design strategy here will be to assemble branching narratives, based on the evidence selected by the evaluator, to offer critique and guidance to teachers. Players will be scored on the teacher's reaction to these conversations, and will be able to hear from expert evaluators about the quality of their interaction. Once the whole process is complete, players will receive general comments about their rating skills, and will be invited to return to specific aspects of the game for practice or to try their luck evaluating the same teacher in a different setting or a different teacher.

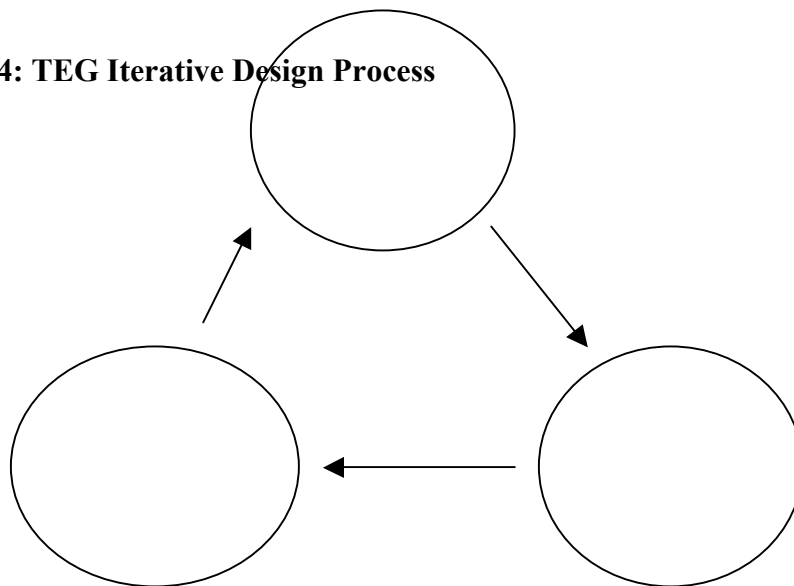## 3.2 Game development process

In the tradition of design research, the research plan serves to organize evidence gathering, learning environment construction, assessment and redesign into an iterative loop (Zimmerman, 2003; Collins, 1996; Cobb, et. al. 2005). An Interdisciplinary Design Team (IDT) will conduct the game development process. The IDT will include teacher evaluation scholars, expert evaluation practitioners, programmers, and learning environment designers who will work together on a design process structured to integrate each perspective into the overall design. The three main steps of the research plan are 1) building the game; 2) assessing the game; 3) analyzing assessment results and planning redesign (Figure 4). Here we will discuss each step in detail.

3.2.1 Building the Game

Building the game is an on-going research and design process intended to produce a playable teacher evaluation game. The goal-based scenario (GBS) design model (Schank, 1992; 2005), in many ways a predecessor to video game for learning design, will serve as our game development template. GBS users face choices, interact with experts, and gather evidence in order to make a decision about the learning goal at hand.

A GBS uses a branching-narrative design that integrates expert opinions into the learning

process in order to guide the player through the scenario. The GBS design process begins

by identifying subject matter experts and relevant research, gathering stories from

practitioners about the represented process, then developing a task-model to slot stories

Analyzing   Assessing
and Planning

into a specified learning path.

Figure 4: TEG Iterative Design Process

Building

        The first step in our development process will be to gather research and stories

about teacher evaluation. The primary investigator has already conducted an extensive

ethnography of teacher evaluation practice (Halverson & Clifford, in press) and has

assembled a video database of pre- and post-evaluation conference interviews with a

variety of teachers and evaluators. In the process of developing the evaluation

ethnographies, the research team also conducted a literature review on teacher evaluation

frameworks, practices and critiques. Assembling the game design materials will involve

further observation and interview research, however, to capture the teacher and expert

perspectives within the game. We will recruit teachers for participation in the project

through our contacts with local districts and professional organizations. Because this

research will involve videotaping minors in classrooms, collecting the video data will

require IRB approval from the University and from the school districts. The result of

data gathering will be ethnographic descriptions of the practice of each teacher and coded

video of each classroom episode that breaks teaching and learning into discernable time-

coded chunks.

  The second step in the game building process involves developing a task model.

Our prior research has informed the design of an initial task model to guide the game

construction process (Figure 5). A task model is the result of a task analysis that breaks

down the evaluation process into a sequential model of smaller practices (Hackos &

Redish, 1998, pp. 55 ff.). The task model organizes evaluation practice into three phases:

evaluation, assessment and teacher conference. The task model serves not only to

organize the game development for the designer, but also comes to serve a pedagogical

function as a working task sequence model for the player.

  The final step of game building process involves knitting together the videos, the

ethnographies and the task model together into a low-tech paper and video prototype.

The integration process will force us to address the gaps in our data collection process.

This early game model will focus on the classroom teaching and expert ratings of one

teacher in order to work out the details of playability and learning.

Figure 4: Proposed TEG Task Model

3.2.2 Assessing the game

On-going assessment plays a key role in an iterative design process. The design

team will conduct a variety of formative and summative assessment activities. The

composition of the design team itself, drawing on the expertise of content specialists,

researchers, practitioners and designers, will provide on-going feedback about playability

and authenticity. The Primary Investigator will serve as the design team coordinator, and

will pay special attention to facilitating the exchange of critical feedback within the

group.

The design team will the test the initial prototype with focus group dyads of teachers and evaluators and collect data through think-aloud protocol analysis (Ericsson & Simon, 1993) to identify the gaps and inaccuracies in game design. Dyads serve to elicit a wider range of perspectives because players can reflect on game play through conversation. The talk-aloud data will also record player insights about their own evaluation experiences (Halverson, Linnekin, Spillane & Gomez, 2004). We will test the high-tech version of the TEG with users to collect formative and summative data. Since the game should by this time provide a coherent play experience, we will use the dyad focus groups with teachers and evaluators to conduct cognitive walkthroughs to trace how players set and solve evaluation problems within the game (Wharton, et. al. 1994). We will collect summative data using the high-tech TEG with expert evaluators and students in Education Leadership courses and seminars. The summative evaluation testing will involve pre-tests of rating a teaching video, providing some time to play the TEG, and post-tests to determine what players learned about evaluation from playing the game. We plan to track our users over time to follow up with interviews or surveys about whether their evaluation perceptions or skills changed as a result of playing the TEG.

3.2.3 Analyzing and planning for redesign

The Interdisciplianry Design Team will play a central role in on-going reflection and design. The IDT will organize and review data collected through prototype testing and develop plans for the web-based, high tech prototype. The IDT will assemble and reflect upon the formative and summative testing data to determine subsequent design steps. The primary investigator will lead design team reflections to address where the design process has uncovered topics for professional theory development and testing.

An expert advisory group will supplement the work of the design team. Prior to the submission of this grant, several experts were invited to serve as members of the advisory group:

- *Charlotte Danielson* is an educational consultant, author and designer of one of most widely used teacher evaluation frameworks;

- *Eric Zimmerman* is a nationally recognized game designer and author. Eric serves as the CEO of gameLab, a game design and publishing company;

- *William Penuel* is the Director of Evaluation Research ad the Center of Technology in Learning at SRI International, and independent, non-profit research institute;

- *Anthony T. Milanowski* is an associate researcher with the Consortium for Policy Research in Education (CPRE) at the University of Wisconsin-Madison. Tony specializes in human resource development and organizational evaluation systems.

The design team with consult with members of the advisory group to reflect on the design and assessment of the TEG. The Advisory Board will meet in together after the first and second year of the project to provide more extensive feedback on the design process.

4.0 Description of how your study will contribute to the theory or the practice of education and who will find your results valuable

Developing video games for professional learning creates a unique opportunity for both the theory and practice of educational leadership. The *research on practice* contribution will follow the research agenda established by the primary investigator to

capture and communicate the practical wisdom of school leadership (Halverson 2002; 2004). The aim of practical wisdom research is to link theory with practice by constructing principled accounts of how expert leaders implement innovate ideas in concrete school situations. The Teacher Evaluation Game will illustrate not only how experts frame and solve evaluation problems, but will also to trace the typical mistakes made by novices and the developmental path practitioners take as they develop an "eye" for the salient features of classroom teaching (cf. Nelson & Sassi, 2000).

The game research and development process also promises to make contributions to educational knowledge. Recent developments in learning assessment suggest that task-models situated in games may provide a valuable means to measure complex cognitive performance (Levy & Mislevy, 2004; Mislevy & Sternberg, 2002). The TEG provided just such a framework for analyzing the skills and knowledge of novice and expert evaluators. Further, proposing game design as a research method promises to bring together game designers, curriculum developers and researchers to build new models for professional knowledge. We will publish papers on the methods and the findings of our work in peer-reviewed education and personnel evaluation journals and will present the findings at national conferences as well as at practitioner conferences.

Providing access to the game itself will provide the central contribution to *research for practice*. The game will serve as an existence proof that video-game technology can create legitimate environments for professional learning. We hope to make the game and the underlying technology publicly available for use in relevant professional learning courses, so that teachers and designers can modify the game to reflect local teachers and standards. Providing public access to the TEG could give

teachers access to how evaluation standards work in real classrooms and give policy-makers, board members and the wider public community members a structured glimpse into what real teaching practice (and evaluation) looks like in real classrooms and brings them face to face with the challenges involved in improvement.

5.0 Clear identification of the principal investigator and a clear definition of the role he/she and any supporting researchers will play (2 ppg.)

The University of Wisconsin-Madison's Games and Professional Practice Research (GAPPS) is uniquely positioned for the TEG research and development project. The GAPPS research group, supported by University of Wisconsin-System and the Academic Advanced Distributed Learning (AADL) Co-Lab, brings together UW-Madison's expertise in learning, game design, evaluation of virtual learning environments. The GAPPS group is nationally recognized as the leading center for the study and design of games for learning, and has received recent support from the MacArthur Foundation, the U.S. Department of Education, the U.S. Army and the Florida Virtual School, among others, to study and develop game-based learning environments.

Primary investigator Dr. Richard Halverson is an assistant professor at the UW-Madison Educational Leadership and Policy Analysis and Educational Psychology Deparetments and a founding member of the GAPPS research group. His ten-year experience as a schoolteacher and principal inform his research on teacher evaluation, leadership expertise and the design of technology-based learning environments for school leaders. Halverson's prior research has studied leader's practical wisdom in urban school leadership (Halverson 2002; 2003; Madda, Halverson & Gomez, in press), inclusion and

differentiation (Halverson and Rah, 2005), teacher evaluation (Halverson, Kelley &

Kimball, 2003; Halverson & Clifford, in press), and data-driven decision making

(Halverson, Grigg, Thomas & Prichett, in press). Halverson has also conducted research

on the design of multimedia learning environments for school leaders (Halverson,

Linnekin, Spillane & Gomez, 2004; Halverson & Rah, 2005) and has explored how video

games might influence school leadership (Halverson, 2005; Shaffer, Squire, Halverson &

Gee, 2005). Halverson's research on the design of multimedia learning environments for

school leaders is currently supported by an NSF Early Career Grant (0347030). This

proposal also includes funds to support two additional research and development groups:

the Instructional Design Team charged with building the game; and stipends for

assessment focus groups of experienced and novice evaluators to provide on-going

formative and summative feedback.

6.0 An explanation of a) how the proposed work fits within the Foundation's focus area,

or b) the unique contribution of the work if it does not fit within a focus area (2 ppg)

Our proposal fits well in the Spencer focus area of "Teaching, Learning and

Instructional Resources." The Spencer Foundation has a long history of supporting

innovative approaches to educational research. We believe that a video-game research

and development process presents the next step in a rich tradition of research agendas that

aim to bridge the theory-practice gap. Specifically, teacher evaluation provides an

underrated but essential support for helping teachers improve student learning.

Researching "what teachers need to know and do in order to enable all students to learn"

first requires that schools develop the capacity to accurately assess current instructional

practices. The practices of teacher evaluation, we argue, are critical for leaders and teachers to grapple with the relation between classroom practice and school reform efforts. Current models of teacher evaluation provide little insight on how exactly evaluators select evidence of quality teaching and assemble evidence into professional learning plans, and often result in watered down practices that serve political rather than instructional goals. The TEG design process will provide hands-on opportunities for practitioners to elaborate and test their theories against expert evaluators. At the same time, the TEG design process will generate the kinds of practical theory that illustrate just how expert (and novice) evaluators use their discretion in actual classroom contexts. Once school leaders and teacher develop vocabularies and traditions for discussing actual classroom practice, real inquiry on the relation of teaching and learning can begin to blossom in schools. The TEG will not, by itself, effect this revolution in school culture, but the development of tools and research programs like the TEG will certainly serve to further the Spencer Foundation's commitment to "creating usable professional knowledge" for school teachers and leaders.

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