Project TECHNOLOGIA: A Game-Based Approach to Understanding Situated Intentionality

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The study described herein is designed to explore the influence of a game-based instructional tool, *Project TECHNOLOGIA*, on student interactions (i.e., occasions where students use Blackboard Learning Management System to post to one another) and how these interactions contribute to a broader understanding of what it is to be a school district technology specialist. By better understanding the way game mechanics influence student learning and interaction, the educational community may begin to isolate the useful elements of game-based coursework that move beyond so-called 'content gamification' that has become a staple of educational gaming (Young et al., 2012). In sum, the project aims to provide: information about the development and evolution of student intentions for learning with the introduction of a dual alternate reality-roleplaying narrative (i.e., *Project TECHNOLOGIA*); an analysis of student discourse with respect to educational technology content set within a dual alternate reality-roleplaying narrative (i.e., *Project TECHNOLOGIA*); correlates of success in traditional versus game-based instructional settings; and implications for the on-going development of educational games writ large.

Based on information drawn from pilot data analysis, the authors hope to expand the current field of game-based learning, both in terms of student achievement and how situated, game-based experiences influence the learning of particular students with particular learning goals playing a particular game in a particular course/program of study. The project is divided into two parts: a qualitative analysis of student interactions (Phase I) and a quantitative follow-up of correlations between student game performance and overall educational technology Master's program performance (Phase II). This mixed methods approach is intended to guide the identification of:

- How a game-based program can be used to examine individual intentions for learning
- How a game-based program can influence the application of domain knowledge

These objectives are embedded in the following research question:

- *What is the interaction between player intentionality, the instructionally-relevant game, and student outcomes?*

Framework for Design

Direct instruction and other traditional educational models perpetuate a separation between learning and the situations to which it is and can be transferred (Everson, 2011). Conversely, problem-based learning (PBL) environments provide an opportunity for educators, learning theorists, and psychometricians to revise commonly accepted means of instruction and assessment to supplement the distal and proximal measurement offered by direct instruction and high stakes testing (Hickey & Pellegrino, 2005). Well-designed games—falling under the broader umbrella of problem-based learning environments—inherently support rich, continuous, embedded formative assessment systems that allow users to reflect on their learning in a situated context. This principle has a long history in electronic portfolio (i.e., e-portfolio) literature (e.g., Camp, 1993; Crutchfield, 2004; Piper, 1999) and makes games an appealing option for the development and implementation of new forms of instruction since they can measure student learning, contextual knowledge, and long-term skill development across time and with great depth.

Regrettably, no studies have addressed the nature of gaming for program-level assessment—that is, a game or games bookending the full course and assignment-load associated with a K12, undergraduate, and/or graduate program. Similarly, no publications discuss the implications of having an overarching narrative structure bound to a months-long problem-based learning environment at the K12, undergraduate, and/or graduate levels (Young, Slota, Travis, & Lai, 2014). This dearth of literature has opened an opportunity for educational psychologists to pursue situated data that identifies how game/program mechanics and narrative, specifically, interact and prompt positive net learning as compared to those that do not. Before researchers can isolate the way(s) student learning in game-based environments actually occurs, however, additional study must be devoted to the exploration of hyperlink pathways, log files, and other process-oriented environmental interactions as defined by qualitative grounded theory analyses of student-student, student-instructor, and student-environment dialogue (Young et al., 2012).

The Game

To begin tackling the identification and cataloguing of valuable game mechanics, narrative elements, and other factors that may be viable areas of exploration in the topics described above, the authors have designed, piloted, and begun formal implementation of a semester-length instructional game built to contextualize district technology specialist responsibilities and behaviors (i.e., educational technology). *Project TECHNOLOGIA*, as it's called, allows for the analysis of key components associated with successful student participation in a game-based learning environment. The program's narrative structure pairs its embedded game objectives with learning objectives at a 1:1 ratio, shifting the traditionally teacher-centered learning environment to a student-centered learning environment where participating students work in research groups, co-construct solutions to complex social problems, and directly participate in tasks typically assigned to practicing educational technologists (i.e., a form of anchored problem-based learning). Through a blend of alternate reality game (ARG) and roleplaying game (RPG) mechanics, *Project TECHNOLOGIA* enables cooperative effort toward resolving contextually rich problems, thus promoting the application of skills necessary to further a broad understanding of what it is to be a K12 school district educational technology specialist.

The overarching story follows the administrators of a fictional space vessel, the Remmlar Array, headed by Duncan Matthau and his assistants, Rheegan Hamilton and Biff Wallace. Over the course of six primary episodes (i.e., content units), students envision, design, and stabilize a new educational system by providing guidance to the space station leaders. This makes the end task–balancing the needs and desires of a K12 school district–the same from both narrative and scholastic perspectives. While it is not a video game, per se, *Project TECHNOLOGIA* exists within the framework of an online text adventure, the ARG framing the students' activities in the program and the RPG framing their online interactions with the characters and narrative content. This choice was made for two reasons: 1) based on existing literature (e.g., Young, Slota, Travis, & Choi, 2014), a fully virtual world can be too confining to adequately fit the needs of a teacher/student and/or inhibit instructor/player creativity and agency; 2) overly complex game mechanics and/or a high technological barrier to entry might discourage all but the most video game-savvy from positively participating.

Initial game development began with the objectives/standards and used them as a guide for developing the narrative rather than the other way around, a design scheme reflective of the top-down approach often associated with strong curriculum development (Bergmann & Sams, 2012). This placed emphasis on the game's ruleset (i.e., how play happens) in order to bring students closer to doing the things real world educational technologists do: problem solve, critically think, examine existing literature, generate new questions, and, most importantly, collaborate toward realistic shared goals (e.g., "develop a comprehensive technology plan that represents a unified vision for the district"). Additionally, because the narrative follows the same trajectory as state and national standards (i.e., NETS/ISTE), the story missions transparently align with the information students need to successfully complete their program coursework and degree requirements. This means that the story is able to carry much of the weight that is usually attributed to direct instruction, allowing the game administrator to use the exploratory prompts as an introduction to content application (i.e., scaffolding both successes and 'productive failures' in problem solving, critical thinking, etc.).

The richness of the *Project TECHNOLOGIA* experience is drawn from the social interactions that take place as a result of student participation in game character teams. On a biweekly basis, each team enters the RPG through a web browser-based heads-up display (HUD) called the Texto-Spatio-Temporal Transmitter (i.e., TSTT; hosted via the teacher-student Blackboard Learning Management System) (Figure 1). The TSTT features a series of immersion sessions that play like media-enhanced text-adventures combined with a fictitious—but deeply content-rich—story arc. The operatives, educational technology Master's program students, are encouraged to use external research, various scientific journals, and information taken from their coursework to synthesize the information they engage with across their Master's program. Specific to the 2013-2014 cohort, teams consisted of two groups of five and one of four, each participant controlling a separate avatar/character in the story. These groups have been and will continue to be guided by a program instructional leader.

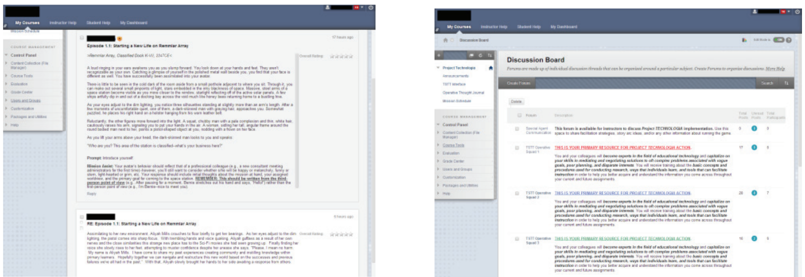

Figure 1: *Project TECHNOLOGIA* Texto-Spatio Temporal Transmitter (TSTT) Display

The "*Project TECHNOLOGIA* Prompt Trajectory" (Figure 2) highlights how the program objectives are represented by a series of narrative episodes, all of which have a "minus," "neutral," and "plus" modification. These team designations lead to very slightly modified versions of the narrative depending on the players' in-game actions (e.g., helping vs. attacking a non-player character). While groups can shift from one track to the next, they cannot shift across two tracks in one session. Importantly, the differences between the "minus," "neutral," and "plus" versions of the narrative are relatively minor (e.g., characters responding with different facial features, slightly different phrasing of ideas) and provide the scaffolding necessary to push the student operatives closer to the primary program objectives (i.e., "Visioning" as defined by the NETS/ISTE standards).

Figure 2: *Project TECHNOLOGIA* Prompt Trajectory

The continuous embedded formative assessment associated with *Project TECHNOLOGIA* is rooted in the player-controlled characters. After viewing an objective-based prompt posted in the TSTT by the instructor, the students collaborate with their teams to decide what actions they will take in the RPG. This allows the instructor to evaluate the learners' thinking and collaboration such that emphasis is placed on the complex skills associated with being a successful educational technology specialist rather than just the character's response product or the types of basic rote information assessed by high stakes tests, final exams, etc.

In transitioning between the ARG and RPG layers, a typical student dialogue might resemble the following (excerpts taken from a pilot instantiation of *Project TECHNOLOGIA*):

Student 1: Sam takes a few moments to gather her thoughts before responding…She feels especially slighted since she tried so hard to placate Rheegan when everyone else seemed to be on the attack…She decides to lick her wounds quietly and immerse herself in constructing educational technology for this new society. Sam decides to address the group as a whole and try to organize some of this chaos. She feels that if she can tap into each person's strengths, they should be able to build a pretty advanced educational system…"Ahem, AHEM—can I please have all your attention for a few moments? Everyone is doing a lot of talking but I don't think many of us are doing a lot of listening. I have been trying to determine how all of us (the non-travelers) can have a voice in setting up this new society."

Student 2: "I believe that if we move forward with Bill's Social Learning theory & Gwen's vision of organizing and implementing lessons that reinforce their learning, we can use technology to foster a cohesive and cooperative educational experience for our citizens. We can promote the use of the internet and the devices that the population already uses to create unique and rich learning experiences for students of all ages. Back home we used a platform called Edmodo that allowed for distance learning and access to content on a multitude of devices. It also had a great badge system for reinforcing learning and desirable student behaviors." She continued, "You know, that makes me think of one of my favorite apps for the iPad and iPhone: Class Dojo. Students earn points for positive behaviors and can also have points taken away for negative behaviors. I know that my behavior up to this point has not been stellar, but I really think this system would benefit our educational programs. Maybe this is something we can implement together as a team."

Student 3: After hearing Sam speak, Brandon stands and collects his thoughts. Many of the things that Sam mentioned made perfect sense…They needed to be good models for the citizens and that needed to start now. "Sam... I like the way you think. We absolutely need to work as a team and use our skills to give this community a model educational system. I think it can be done, but there are definitely some questions that need to be answered before we can create something wonderful. Duncan, you mentioned technology. Along with Sam, I would also like to know what we have available to us and to the citizens and what technology, if any, the citizens of Remmlar Array are already familiar with. Is there anything that they know how to use that we can use in conjunction with the technology you are making available to us?"

Student-student interactions via the TSTT HUD afford the instructional opportunity to facilitate the correction of misconceptions in real-time rather than providing direct instruction and waiting for summative assessments to dictate end of unit or whole course achievement. Feedback often includes veiled critiquing through a character in the game's plot or direct intervention as the course instructor. For example:

Instructor: "I've been an administrator for a long time, and I've never come into a new and changing situation and found the group ready and waiting with a shared vision and a set of prioritized objectives they wish to pursue together. That's crazy talk. Getting the folks on this station, our new home, talking together so that they can co-construct a shared vision—" A wave of yelling momentarily breaks his train of thought. "*THAT'S EXACTLY WHAT WE NEED YOUR HELP IN DOING*.

"…You have to understand that many of these folks are set in their ways...Your ADDIE model and needs assessment may be helpful eventually, but right now they need a chance to interact, to become vested in the process, and to feel like they have been heard. They need a chance to understand the possibilities, and together set those priorities... your so-called behavioral objectives."

Dialogic interactions like those sampled above emphasize the way *Project TECHNOLOGIA* focuses on knowledge gains by placing learners in complex, problem-rich contexts that require application, creativity, and self-evaluation of learning. This permits the teacher to emphasize and evaluate action on all tiers of Bloom's Taxonomy rather than focusing on one or two at a time. Altogether, the assessment process exemplifies the constructivist nature of the program by allowing students to piece together on-going portfolios that establish longitudinal, experiential knowledge growth over the breadth of the Master's program, exhibiting the cumulative spiral effect described in Bruner's four governing principles of constructivist instruction (Slota, 2014; Young et al., 2012).

Research Methodologies

Qualitative (Phase I)

Game environments are situated much in the same way as other learning contexts and, by definition, rely on social interaction. Consequently, the study hinges on student-student and instructor-student dialogue throughout gameplay (i.e., occasions where individuals post to one another in the RPG). It follows to utilize grounded theory analysis set within an interpretation theory framework to extract meaning from player/student interactions over the course of *Project TECHNOLOGIA*'s implementation (Author, 2012; Potter & Wetherell, 1987; Rennie, 2007; Thomas, 2003). Like other qualitative methods, grounded theory analysis is inductive in nature, though *Project TECHNOLOGIA* places specific emphasis on open, interpersonal dialogic loops between participants in lieu of participant responses taken in isolation of one another (Cheek, 2004). For this reason, all qualitative information collected across the study is set to be divided into dialogical units of analysis (i.e., interactions between individual players and the game with respect to individual goals/intentions) so that the authors might capitalize on the interpretive affordances of dialogic loops (e.g., 'ways to improve future performance', 'instances of real or perceived failure', 'points of critical thinking'–any units that can be extrapolated into broader macrocategories of discussion) (Bakhtin, 1981; Foster & Ohta, 2005). Participant thought journals/logs (i.e., participant-maintained journals used for jotting down out-of-game thoughts, ideas, etc.) will expand upon participant goals and intentions at the time of making in-game posts—this will permit the capture "internal" snapshots that may lead to a much richer assessment of individual differences among participants.

There is no singularly correct way to administer this approach. However, several steps tend to be consistent across the studies in which it has been applied (e.g., Shaw & Bailey, 2009). These steps allow the researcher to make inferences about social interaction based on primary statements/questions and the responses they yield (Thompson, 1988). Because meaning, symbols, knowledge, and other abstract concepts are socially constructed, this is especially helpful in establishing how complex social behaviors such as group learning manifest in real-world (i.e., in vivo) contexts (Berger & Luckman, 1967; Lave & Wenger, 1991; Vygotsky, 1978).

To that end, the authors have used pilot data to establish several assumptions prior to the analysis of data involving this iteration of the game, specifically: 1) the interactive process (or processes) is favored over outcomes and products; 2) data collection and analysis come exclusively from the researcher, meaning that all data necessarily filters through an individual rather than a machine or piece of software; 3) subjects must be studied in context, implying the need for fieldwork (in this case, understanding student situations and the context for communication); 4) data analysis centers on interpretation and the emergence of meaning; 5) there is inherent orientation toward constructing hypotheses, concepts, and theories from details rather than using details to confirm or deny existing hypotheses, concepts, or theories; 6) all interactions are formed as the result of dialogue and meaning will come from the formation of dialogical units (Bakhtin, 1981; Creswell, 1994; Hathaway, 1995; Merriam, 1988). The accepted structures and methodologies associated with quantitative study prevent quantitative researchers from capitalizing on the aforementioned assumptions, thus inhibiting the explanation of how and why learning occurs. As a result, grounded theory analysis serves as a more advantageous selection for establishing how and why participating students develop particular individual intentions, co-construct particular types of solutions, and adopt particular strategies in *Project TECHNOLOGIA*.

Quantitative (Phase II)

The combination of a limited sample size (n=14) and lack of standardized benchmark exams make it extraordinarily difficult to take a predominantly quantitative approach with *Project TECHNOLOGIA*—the number of participants needed to create experimental/comparison groups and achieve appropriate statistical power is roughly 200-300. Achievement measured by way of final program artifact grades/evaluations will instead be used as a rough guide for the researchers to correlate student performance and play choices in the game with student performance in the overarching Master's program. This means that there are no variables to manipulate, per se, but the quantitative portfolio elements will act as descriptive tools that aid in establishing player/student intentionality, personal goal-setting/achievement, and engagement with the program as a whole.

Preliminary Findings

The iterative instructional design process underpinning *Project TECHNOLOGIA*'s development has yielded valuable information about how the game affects student learning, engagement, and the ability to apply skills associated with a K12 educational technologist. Additionally, findings from the pilot have shaped the authors' expectations for the current implementation by offering insight into possible and/or probable outcomes pending the end of the current implementation cycle (i.e., May/June 2014).

First, student-student and instructor-student interactions observed throughout the *Project TECHNOLOGIA* pilot indicated that the timeline for content release and quality of online interactions were critical in shaping the overall experience for both instructors and students. This issue is well-established in the context of drug abuse prevention programs and is defined by five major measures of fidelity: Dosage, Adherence, Program Differentiation, Participant Responsiveness, and Quality of Program Delivery (Dusenbury et al., 2003). In particular, Dosage (i.e., frequency and complexity of new prompt episodes) and Quality of Program Delivery (i.e., depth of shared storytelling/interactions) served as strong determinants for student engagement and, taken together, acted as a kind of 'canary' for long-term implementation success. Though the authors originally anticipated that one episode per month would be sufficient for maintaining interest and success, it quickly became clear that students tended to forget major plot points, lose focus on their objective(s), and stop participating when disengaged for more than two weeks and/or receiving only general responses to specific character actions. The game has since been revised to feature bi-weekly episodes and additional material (e.g., character-specific expository dialogue) aimed at improving Dosage and Quality of Program Delivery.

Related to this issue, dialogue sampled from the pilot and current implementation suggests that the underlying narrative is rich and dynamic enough to be engaging, but it requires regular instructor-driven updates to compete with higher-prioritized Master's program coursework and assignments. As a post-pilot remedy, the authors targeted areas of the existing narrative that most appealed to pilot participants and/or generated high-quality discussion/debate (e.g., conflicts between characters, arguments, a riot initiated by non-player characters)—a means to introduce additional opportunities for student participation and fortify comparatively weak plot points. This has expanded the narrative such that the authors believe it more aptly capitalizes on the "teachable moments" that emerged during the pilot and improves the likelihood that individual intentions will be more easily identifiable after the current implementation.

Data observed in the early stages of the current implementation indicate that answering the research question "What is the interaction between player intentionality, the instructionally-relevant game, and student outcomes?" may be deeply embedded in how an instructor tailors a game's story toward student actions, perceptions, and choices. This is not to say that open-endedness and unlimited student agency are the governing factors in all game-based learning environments but rather that well-guided player action—as facilitated by a compelling narrative—may be the biggest contributor to emergent student intentions for learning and application in an ARG/RPG. If true, the implication would be that narrative is at least as important to the long-term fidelity of a game-based learning program as the game's other mechanics, thus lending support to the notion that high-end game graphics are not necessary for maintaining engagement so long as the narrative and learning objective structure generates sufficient appeal. Importantly, however, final judgments about these and other extrapolations will remain purely speculative until we near the end of the current implementation (i.e., May/June 2014).

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