The Instructional Design of an Educational Game: Form and Function in JUMP

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ABSTRACT

This paper will tie principles of good game design to principles of learning. It will describe their impact on the instructional design model of JUMP Into Reading for Meaning (JUMP) and address the core issue of how JUMP uses game design and learning principles to create an educational game that engages students in learning.

Capitalizing on the ubiquitous use of games by children and youth in society today, the emerging use of gaming in education offers an approach that is completely different from common uses of technology in school environments. Common educational uses of technology range from telecommunications and distance learning to accessing networked resources or computer-based software tools. Where games are used in classrooms, many are deemed to be "boring" because they are basically electronic versions of pencil/paper worksheets (eSchool News, 2007). There is growing momentum to use games as serious innovative learning tools to help students learn. Even the Federation of American Scientists (FAS), which typically weighs in on matters like weapon systems and military intelligence, recently released a report in support of the potential of games to redefine education (FAS, 2007).

JUMP is an educational game that goes beyond presenting content as an electronic version of pencil/paper worksheets. JUMP provides an immersive game environment in which students are active participants in their learning. From research, product testing, and use testimonials, there are key attributes that separate good games from formulaic multimedia software and pedestrian games. Because it fuses good game principles with educational content, JUMP is a game that is also a strong educational tool.

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WHAT IS A GAME?

Game historian David Parlett defines the formal game as having a twofold structure based on ends and means. The ends structure is a contest to achieve an objective. To achieve that objective is to win. The means are an agreed upon set of equipment and "rules" by which a winning state can be achieved (Salen & Zimmerman, 2004). In another definition adapted from Rouse's *Game Design: Theory and Practice* (2005), games are the presentation of an entertaining challenge to the player—a challenge that the player can understand and may be able to succeed at by using his or her knowledge, wit, and dexterity.

The wide variety of video and digital games ranges from action games (e.g., *Gears of War, Ikaruga*), which keep players moving and require eye/hand coordination and quick reflexes; to strategy games (e.g., *Civilization,* a civilization development game), which are often recreations of historical events; and role-playing games (RPGs) (e.g., *Skies of Arcadia, Final Fantasy VII*) that revolve around characters and stories that take place in expansive worlds.

JUMP is a hybrid role-playing/adventure game. While many of these video games are accessible through a television and game console or computer, JUMP's gaming platform is a handheld game console—the Nintendo DS™. The Nintendo DS™ is one of the more popular mobile game consoles for the JUMP 4th grade target audience. *DS* stands for *Dual Screen*, referring to the device layout of two screens placed one on top of the other.

GAMES AS EDUCATIONAL TOOLS

Video games and gaming evoke mixed reactions. Advocates point to such benefits as entertainment value and the joy of challenges. Opponents are troubled by issues like violent themes or the amount of time spent in game play by youth. Regardless of personal perspective, video games have secured a strong place in popular culture and the entertainment media market. The reality

of the matter is that digital gaming is a multi-billion dollar industry that has become part of our modern culture (Van Eck, 2006). Garris, Alhers, and Driskell (2002) report that some empirical evidence exists that games can be effective tools for enhancing learning and understanding complex subject matter (Cordova & Lepper, 1996; Ricci, Salas, & Cannon-Bowers, 1996), and that though these studies are still developing, recent research has begun to establish the links between instructional strategies, motivational processes, and learning outcomes.

Another dimension of design considerations are added once a game is identified as educational. The game goals are not simply those of game completion, but also the attainment of instructional objectives. Beyond luring the learner into the world of the game, the goal of an educational game is to engage the learner in meaningful activities that not only fulfill the psychological needs provided by gaming experiences, but also support cognitive processes and instructional content in ways that make the learning relevant and authentic in the game context. In short, educational game designers strive to use the motivational properties of computer and video games to capture learners, enhance learning, and reach instructional objectives.

What underlies the allure of games? As educational game professor Dr. James Gee asks, "How do good game designers manage to get new players to learn their long, complex, and difficult games and not only learn them but pay to do so?" (n.d.b, p. 1). A well-designed game entices players into the "reality" of the game world and keeps them there until the goals of the game have been met (Salen & Zimmerman, 2004). Gee points out that incorporating appropriate challenges that are "doable," and other widely accepted effective learning principles that are supported by research in cognitive science, are, in fact, a large part of what makes good video games motivating and entertaining (n.d.b). JUMP believes that by using effective learning principles, good game design principles, and sound learning objectives, games can be a viable educational tool.

CHARACTERISTICS OF GOOD GAMES

In JUMP, game characteristics couple with instructional content to create an interactive educational game space for players. Garris et al. (2002) determined that though games themselves may not be sufficient for learning, elements of games can be activated within an instructional context that may enhance the learning process. Using the model explained in Garris et al.'s report *Games, Motivation, and Learning: A Research and Practical Model,* JUMP design focuses on the game characteristics of fantasy, rules/goals, sensory stimuli, challenge, mystery, and control. As an adventure/role-playing game, genre forms and functions also impact the design of JUMP, and are discussed in detail here.

Fantasy

Games take place in a world that is separate from reality and may involve imaginary worlds, activities, and characters that don't rely on the real world that surrounds the player. Garris et al. (2002) report that research indicates instructional content embedded in fantasy contexts leads to greater student interest and increased learning (Cordova & Lepper, 1996; Parker & Lepper, 1992). Good games offer players identities that trigger a deep investment on the part of the player. Story and narrative are both contributing factors to this. The goal of good game design is to offer a character so intriguing that players will "want to inhabit the character and can readily project their own fantasies, desires, and pleasures onto the character" (Gee, n.d.b, p. 7).

The JUMP team capitalized on interests of the target audience by identifying common story themes and conflicts popular in youth media (good vs. evil, kids as heroes, time and space travel, and futuristic technologies) to create a fantastical world in which the player takes center stage. In the JUMP world, as players start the game, they first name their playable character (PC) and select the character's gender. At this point, the player becomes part of the story through the main character, inheriting the storyline, goals, and persona of the character. Throughout their adventure, players traverse scorching deserts, dense jungles, arctic snowscapes, strange undersea terrains, and even another planet on their quest to save their best friend, the sweet and lovable dog, Hugo.

Rules/Goals

Although games are separate from the real world, game worlds still exist in a fixed space that is governed by rules and boundaries. This fixed space is the area where the player makes decisions based on the game goals presented. Good games integrate a number of complex elements—moments of decision making, challenging goals, rewarding feedback, etc.—within the game space to create a fun play experience. Salen and Zimmerman (2004) have distinguished between the macro level of a game's pleasure—the player's pursuit of the goal, and the micro level—the player's engagement with the core mechanics, or the action of the player and the form of the game system in play.

Linking the two are *short-term goals*. Salen and Zimmerman state, "Along the way, the player struggles toward short-term goals, each one providing a kind of pleasure that is less immediate than the instant gratification of the core mechanic, but more rapidly obtained than the long-delayed ultimate outcome of the game"(p. 343).

Locke & Latham (1990) report that "one of the most robust findings in the literature on motivation is that clear, specific, and difficult goals lead to enhanced performance" (as cited in Garris et al., 2002, p. 6). While the JUMP story drives macro-level game goals (e.g., find your dog, get word chips for your robot, defeat the bad guy), short-term game goals directly link player quests to the content to be learned. As the JUMP story progresses, players

make choices based on their word knowledge to accomplish goals. For example, when the main character is tasked with giving a robot the *appearance* of a mime, the player must ask the artist for assistance. At that point, the player's understanding of the word *basic* would help him or her select the correct paint from the artist's bag (choosing between black and white, neon, and glow paints), thus achieving the short-term goal by exhibiting knowledge of the educational content.

JUMP supports players with tutorials and feedback that inform of rules and goals. An important aspect of the effective use of in-game goal structures is the ability of the game system to inform the player of progress and provide resources and supports when needed. Tutorials and player resources are most beneficial to a player when they are provided "'just in time'—near the time it can actually be used or 'on demand'—when the player feels a need for it and is ready for it" (Gee, n.d.b, p. 17). JUMP's tutorial system takes place "just in time" as a forced instruction on a player's first encounter of a game mechanic and "on demand" through an in-game help menu. As the JUMP game system provides the player with resources and help information that support the game play, the player is able to make better decisions in the boundaries of the game world's reality.

Sensory Stimuli

Game rewards may be ancillary or practical. Good games use both ancillary and practical rewards to support engagement and motivation. Practical rewards in a game may take the form of experience points, ranks, skills, and abilities. These rewards are all directly linked to the player's ability to be successful in the "play" of the game. JUMP uses ancillary rewards—visual, aural, decorative, such as a musical score, sound effects that build individual characters and indicate successful player interactions, vivid visual environments, and strategically placed cutscenes that not only serve to advance the story, but also validate the completion of larger game quests. Sound effects, graphics, and other sensory stimuli that are strange or unfamiliar can be attention-grabbing, as noted by Malone and Lepper (1987), but can also appeal to the desire for sensory disorder and sensations that are outside normal experience. Key visual rewards, such as cutscenes and other scripted action events, visual wonders, and landmarks can dramatically affect the pace of gameplay (Lopez, 2006).

Challenge

Good games are fun. However, fun isn't always easy. Nicole Lazzaro, recognized in the game industry for conducting user playtesting and studies in player emotion, has separated player experiences into "easy fun" and "hard fun" (2004). Easy fun maintains focus on player attention rather than a winning condition. Players who enjoy "easy fun" report that they like exploring new worlds with intriguing people, excitement, and adventure. Hard fun creates emotion by structuring experience toward the pursuit of a goal. The challenge focuses attention and rewards progress to create emotions such as frustration and *fiero* (Italian for *personal triumph*).

Challenges in JUMP are designed to be meaningful to the player. For example, *Bot Battles* require the player to answer word knowledge questions that are written for higher level content application; the questions require the player to know definitions and apply them to a situation, rather than correctly performing a basic definition match. While these questions are challenging, they support the macro-level goal of restoring Buddy's (the PC's robot sidekick's) VRBL chips in order to help him regain memory and communication skills. Successes in these challenges become meaningful to the player as they strengthen Buddy, achieve goals that lead to practical game rewards (points and skills), and move the player forward in the goal to defeat the bad guy.

Malone and Lepper (1987) have claimed that individuals desire an optimal level of challenge; that is, people are challenged by activities that are neither too easy nor too difficult to perform. JUMP game goals and challenges are intended to be, as Gee (n.d.b) calls them, "pleasantly frustrating in the sense of being felt by learners to be at the outer edge of, but within, their 'regime of competence'" (p. 5). That is, challenges are hard but doable.

Mystery

Though they are important, the excitement of games does not magically emerge from fancy graphics, well-written stories, or point-based rewards. Good games integrate a number of complex elements to create a fun play experience (Fortugno & Zimmerman, 2005). Malone and Lepper (1987) note that curiosity is one of the primary factors that drive learning. However, mystery differs from curiosity in that mystery is external to the game itself. Mystery will evoke curiosity.

Strongly connected to the use of fantasy, JUMP fosters mystery and player curiosity with a compelling story in which each level takes place in a new, rich, and diverse environment, generating novel experiences in which the player should expect the unexpected. Who would expect to catch a ride on a submarine from a rainforest with a penguin? What would compel a pirate ghost chicken to blast himself from an underwater cannon? And why would a maniacal robotic muffin-shaped fish want to take over the galaxy? The gap between what the players know and what the players want to know drives them to progress in the story, thus moving them forward in the game and instructional goals.

Control

Control is the exercise of authority, or the ability to regulate, direct, or command something. Games evoke a sense of personal

control when users are allowed to select strategies, manage the direction of an activity, and make decisions that directly affect outcomes, even if actions are not instructionally relevant (Garris et al., 2002). Rooted in self-determination theory (SDT), the research of Przybylski, Rigby, and Ryan (2006) of Immersyve, Inc., has identified three psychological needs that form the underlying motivational energy of video games: *competence, autonomy*, and *relatedness*. Of these three psychological needs, autonomy is most closely linked with player control. Autonomy relates to sense of volition or willingness when doing a task (Deci & Ryan, 1980, 2000). When activities are done for interest or personal value, perceived autonomy is high. JUMP puts players in control of their game progression. While the story outcomes are not open-ended, and the instructional objectives steer the player through choices that have correct and incorrect responses, the player is still able to make decisions in the gameplay that have a direct impact on game success.

Genre and Form

In addition to the six game characteristics explained above, game genres impact the design of game form and mechanics. *Pokemon*, a highly successful game, influenced JUMP's design as a hybrid of an adventure game—a type of game where the player is the protagonist who determines the best path to reach a goal, and a RPG—which is usually collaborative and revolves around characters and the story in an expansive world. As a RPG/adventure game, JUMP has developed game systems around the areas of exploration, challenges (more commonly known to the game industry as combat[1]), and puzzles or minigames. With an educational focus, the design team developed interactivity in the RPG game structure that actually allows genuine *play*, not just quiz-style questions and answers (Fortugno & Zimmerman, 2005). Exploration, combat, and puzzles in JUMP provide gameplay experiences that utilize all of the game characteristics described above; fantasy, rules/goals, sensory stimuli, mystery, challenge, and control are all a part of JUMP gameplay activities and mechanics.

Exploration

Players explore the world of JUMP using their in-game PC avatar, an image that represents and is manipulated by the player. In exploration, the player walks around, meets and talks with other characters, engages in quests and other activities, and makes discoveries in his or her environment. Dialogue with non-playable characters (NPC's—the characters that the player does not directly control) provides a rich environment for multiple and varied exposures to target vocabulary words. As players build their fictional in-game social network and experience words used in context, they are able to process meaningful use of words, contextually supported to connect the new to what is known. For example, in Level 3, the PC is rushing to save Hugo, and tells the Chimp, "I'm in a hurry, though, so I have to work with haste." The target word is *haste*. The target vocabulary words are presented to the players in ways that are "situationally relevant" to the story, and text is written at a readability level appropriate to the target audience. In addition, as the player progresses through dialogue, the player will make response choices for the PC that show the correct use of targeted words. The game reward system includes points for correct word use and finding all in-dialogue exposures of target words.

In addition to game dialogue, exploration is an avenue for discovering hotspots ("Easter egg" style discoveries—an industry term used to describe hidden extra features that are not usually needed to advance the story, but provide some sort of benefit, even intrinsic, to the player). Hotspots give context-specific connections to word meanings. For example, a tap on the screen to the subtle sparkle on a Sundowner Hotel horse guest (Level 1) reveals the text, "My, my, my . . . in this harsh heat, my poor horsy forehead is getting moist with horsy sweat!" In this example, both *harsh* and *moist* are target vocabulary words. Discoveries provide players with factual information about concepts, building their foundation of word knowledge. Building the spirit of exploration and discovery within the game supports the idea that word meaning is deeply connected to the world around us.

Combat

While the player moves about the game world, he or she may be launched into combat against an evil Bad Bot. Players are protected by Buddy, a player-controlled robot who must challenge opponent Bad Bots in order to recapture his missing VRBL microchips. Combat in JUMP is a turn-based system inspired by conventional Eastern RPGs like *Dragon Warrior* and *Pokemon*. The player and the Bad Bots take turns selecting attacks against each other, and the player goal is to wear down all of the opponent's power via attacks before the opposing Bot wears down Buddy's power. When the player is successful, the Bad Bot is stunned, and must be disarmed. When Buddy disarms a Bad Bot, the player is presented with a question that, when correctly answered, yields a new word-based microchip (VRBL chip) for Buddy. As the player earns experience by defeating Bad Bots and answering questions that use the player's word knowledge, Buddy earns even more powerful combat abilities.

Bot challenge questions use words in a prompt/response situation that may include words from the current level as well as recycled words from previous levels, and that requires higher-level word knowledge and application. If the player does not "pass" the word (acquire the VRBL chip) in the Bot challenge, it may be repeated in the Bot challenges within the level, thus giv-

[1]In the descriptions within this document, language may include industry standard terms such as "combat," "battle," and "enemy." It is important to remember that in-game activity references will identify combat and battle experiences as "challenges" and enemies as "challengers." Although JUMP is designed to feel, in some ways, like a Saturday morning cartoon, the subject matter is carefully designed to maintain educational value and steer clear of the more violent leanings of some modern children's programming.

ing players additional practice with words that have proven difficult. Players must pass all words for their current level before exiting the level; the player is thus required to demonstrate competence with the target vocabulary before progressing.

Boss Challenges

In addition to the Bot challenges, the Boss challenge must also be passed before the player can exit the level. Using the same mechanics as Bot challenges, the disarming questions target the use of word learning strategies rather than vocabulary knowledge. Each question that the player is presented with uses the targeted level strategy (specific content clues, prefixes, suffixes).

Puzzles and Minigames

JUMP features a series of fun minigames that allow the player to recharge and repair Buddy while reviewing word meanings and learning reading strategies. By merging the game systems for player interaction with the hardware strengths of the Nintendo DS™ platform, JUMP creates a unique experience that moves beyond those offered by conventional handheld role-playing games. From using the microphone to blow out fires in the Chip Repair "semantic mapping" minigame, to using the touch screen to control velocity and trajectory in the Recharge minigame, JUMP takes advantage of the DS hardware to create surprising new gameplay challenges and opportunities.

Word Knowledge

Players repair Buddy after combat by using the stylus to solve semantic mapping multiple choice questions. Players recharge Buddy's power at special stations by launching fuel cells into power sockets using a stylus activated slingshot. The fuel cells are earned by successfully answering definition match questions. Words from past levels can be integrated to move word knowledge from short- to long-term memory, as is appropriate for individual student learning (word mastery).

Strategy

The strategy activity takes place immediately following a successful Bot challenge. Once the player has successfully taken a VRBL chip, he or she discovers that there is an extra battery inside the Bad Bot. By using word learning strategy skills, the player can decrypt the security lock on the battery and obtain it as an item for future use in Bot challenges.

JUMP GAME DESIGN

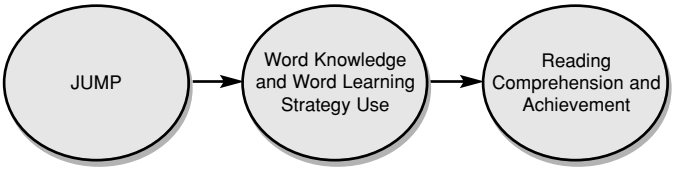
Program Requirements

The JUMP program is a research-based, situated learning, game-based educational and instructional curriculum for supplemental educational services (SES)—a hybrid vocabulary instructional program and RPG/adventure game for the Nintendo DS™. The JUMP curriculum targets 4th grade students to address the well-documented drop-off in reading test scores, as these students encounter progressively more difficult texts and content.

Product Use

The JUMP conceptual model (Figure 1) illustrates a causal linkage between using the JUMP game and both increased vocabulary and increased word strategy skills, which in turn lead to increased reading comprehension and achievement. An evaluation study is planned, which will assess whether students in after school programs improve their vocabulary acquisition and word learning strategies, as well as add to the research regarding the overall feasibility of digital games as a medium for school-based learning. At the end of the evaluation study, JUMP will be poised to provide data on whether research-based vocabulary methodologies are effective on a gaming platform.

FIGURE 1
JUMP Conceptual Model



JUMP provides a response system different from traditional reading interventions. Using Nintendo DS™, a game delivery system that is well-known and generally regarded positively by this age group, struggling readers are given an immersive game environment in which their success is a direct result of their effort. That is, these challenges feel hard but doable (Gee, n.d.b). And to combat the defiance and lack of motivation that teachers may attribute to struggling readers, tried-and-true industry design standards shape the game system for the educational content presented in JUMP.

The JUMP Game Design Model

The JUMP game design model merges the JUMP conceptual model with the Input/Process/Outcome game model found in the Alhers et al. report *Games, Motivation, and Learning: A Research and Practical Model* (2002). The JUMP game design model, illustrated in Figure 2, indicates the program requirements that have set the primary course for the project development. Content specialists created and organized instructional content to support program requirements, and game and instructional design

specialists then integrated the content into a game design that utilized key game characteristics of fantasy, rules and goals, sensory stimuli, challenge, mystery, control, and genre and form. These characteristics are not only supported by industry literature and reports of good game qualities, but also include educationally supported learning principles.

The merging of instructional goals and game design result in the JUMP game. A cycle of player judgments and behaviors and system feedback move the learner toward achieving game and instructional goals and ideally meeting predefined learner outcomes with success. The pages that follow elaborate on each element of the JUMP game design model, citing research and industry literature that shaped the design, resulting in the educational tool that is to be played on a Nintendo DS™ by struggling 4th grade readers. The focus of this paper is the instructional and game design; information regarding the content's research base is available on pp. 53–60 in *Theory and Research Into Practice: Examining the Role of Gaming and Learning in Vocabulary Instruction for Struggling Readers* by Cheryl Taitague (2007; in this volume).

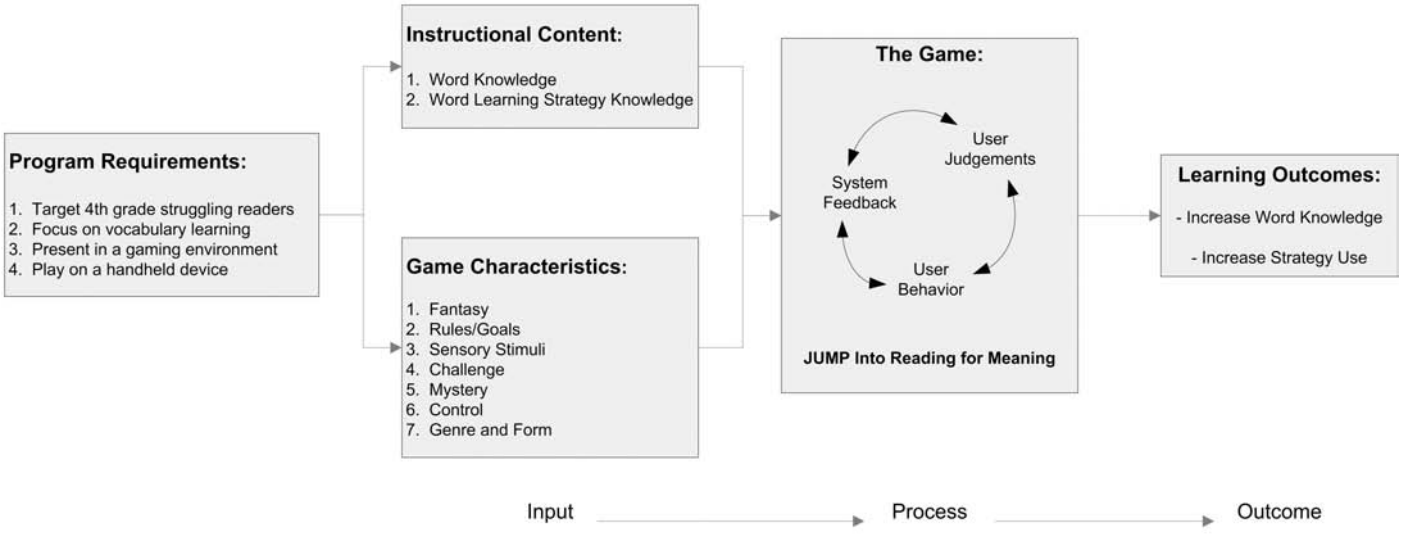
INSTRUCTIONAL CONTENT

One feature in all good educational games is a marriage of form and content (Fortugno & Zimmerman, 2005). The JUMP story and educational objectives work together to form gameplay metaphors (how the story of the game is carried through all learning activities), generating a game system that translates player knowledge (e.g., definitional word knowledge, word learning strategy) into relevant game skills and goals (what the player needs to do to "win").

With vocabulary acquisition skills as the instructional focus, JUMP focuses on increasing vocabulary and improving word learning skills through contextual and affix analysis. Players encounter and use vocabulary words and word learning strategies in different contexts. For example, the player may encounter a word in multiple contexts while reading branching dialogue and student-friendly definitions or through activities that require the application of word knowledge to respond appropriately to characters (word validations) or achieve a goal (word interactions), or the player may encounter the words in ways that enable him or her to see how words relate (semantic associations). All of these experiences are tied together through a story in which players pursue a macro-level goal of finding their kidnapped dog.

Traditional games reward players for good game play; game value is placed on the ability to be a good game player. However, because it is an educational game, JUMP's reward structures must value the correct application of target vocabulary and concepts, and not simply good game play. Rewarding traditional game skills over the correct application of target concepts would make it possible for good gamers to be successful in the game without demonstrating competence in the educational objectives. A game design that valued game play over instructional content could also unfairly punish learners who are mastering the learning content, but are unskilled gamers. The design goal of JUMP is to support the instructional content in a game environment by creating a game system that balances skill, value, and reward to engage the gamer while supporting the non-gamer and aligns game achievement with success in applying educational content in game contexts.

FIGURE 2
JUMP Game Design Model



Word Knowledge

Increasing word knowledge is one of the two instructional focuses of the JUMP game. JUMP's vocabulary content is divided into content-specific and high-utility words. Content-specific words target the disciplines of science, math, and social studies. High-utility words in JUMP are commonly used in basal texts to support content words, are high-frequency words used by mature language users, and/or are selected from analytical studies of basic words in grade 4.

It is important for designers to create environments in which players can generate situated meanings.

> People are poor at learning what words mean when all they get is a definition that spells out what a word means in terms of yet other words. Recent research suggests that people only really know what words mean and learn new ones when they can hook them to the sorts of experiences they refer to—that is, to the sorts of actions, images, or dialogues the words relate to. (Barsalou, 1999; Glenberg, 1997; as cited in Gee, n.d.a, p. 8)

Knowing that words and concepts have their deepest meanings when they are clearly tied to perception and action in the world (Gee, n.d.b), JUMP's story and subsequent game goals become critical for generating a game space in which players can make word meaning and content connections.

JUMP presents players with multiple opportunities to acquire information about word meanings, as well as providing multiple exposures to words in a variety of contexts and settings. Through a compelling story narrative, exploration, and activities, players are able to "practice" with words, responding to words both affectively and cognitively to promote rich and sustained knowledge of words and their meanings. The game design aligns to criteria set up for player word encounters, such as a minimum number of exposures in context and minimum numbers of word interactions and interactive word verification questions in dialogue (described in detail in the Exploration section). While embedded in contextually relevant play opportunities, word applications may range from lower level to higher level. The game systems have been structured in such a way that each word should appear to the player a minimum of eight times per level. Word knowledge assessment is formative through the use of challenges against Bad Bots (described in detail in the Combat section).

Word Learning Strategy Knowledge

The second instructional focus of the JUMP game is word learning strategy knowledge. Each level (with the exception of Game 1, Level 1) provides direct teaching instruction for a specific word learning strategy in either context clue analysis or affix analysis. Strategy tutorials are not forced; rather, they are "on demand," meaning players have the option of accessing the instruction when they need it. Players practice applying word learning strategies through a battery lock decryption minigame. Assessment of learned strategies takes place in level Boss Challenges (described in detail in the Combat section).

THE GAME CYCLE

Players experience engagement in gameplay through a cycle of user judgments, user behavior, and system feedback (Garris et al., 2002). The game design must include attention to the game cycle by planning for system feedback in response to player actions in the play process. Csikszentmihalyi (1990) describes the positive experience of being completely engaged as reaching a state of "flow." Csikszentmihalyi defines flow as "the state in which people are so involved in an activity that nothing else seems to matter" (p. 4). When players are immersed in the game experience with a willingness or desire to engage in the tasks presented, the result is a deeper level of experience with the learning opportunities presented in-game.

From the beginning of a gameplay experience, the user makes judgments about whether the game is fun, interesting, or engaging (Garris et al., 2002). Players' interest, immersion, and confidence in their gameplay experience has direct implications on their attainment of instructional goals. Research suggests that learning improves as the quality of cognitive engagement increases, and that greater engagement during learning leads to longer retention of information (Hannafin & Hooper, 1993).

The player's judgments and perception of game goals and play rules (how the player may act and progress in the boundaries of the game world) impact the player's behaviors. As the player makes decisions and interacts with the game system, the game system responds. The basis of interaction is that nothing happens in the game until a player acts and makes decisions. The game then reacts, giving the player feedback and new problems. This process moves the player forward through the game experiences, goals, and objectives. In the consideration of games and literacy, this is crucial if people are to have more than just words for words—if they are to be able to cash out words for experiences, actions, functions, and problem solving (Gee, n.d.c). As the player moves forward in the game experiences, user judgments may be modified, impacting behavior, triggering new system feedback, and continuing the game cycle of engagement.

System Feedback

Good games use in-game mechanics and player feedback that align to the context of the game. In addition, good video games lower the consequences of failure; players can start from the last saved game when they fail. Players are thereby encouraged to take risks, explore, and try new things (Gee, n.d.a). In an envi-

ronment that values the correct application of target content without punishing players for taking risks, failure becomes fun and central to the learning. In-game redirection can also help players solidify the skill sets that are lacking in the game. As Fortugno and Zimmerman said in their Gamasutra article "Learning to Play to Learn" (2005), "playing the 'wrong way' might be just as educational as winning!" (p.4)

Learners need to know how skills translate into strategies for playing the game (Gee, n.d.b). This takes place through the game cycle and system feedback. JUMP provides player feedback both in victory and failure, redirecting the player in game-relevant contexts (e.g., incorrect PC responses in dialogue, spoken audio feedback indicating strategy hints in the battery lock minigame) and affirming correct decisions with both intrinsic and extrinsic rewards (e.g., story progression, item acquisition, quest completion, experience points). For example, in the JUMP game system, players challenge Bad Bots to acquire VRBL chips. The more Buddy battles, the more he uses up health and power. Health and power are regained through Chip Repair and Recharge minigames. Incorrectly answered target words in battle are high-priority content in both minigames, thus giving players more practice in their problem areas. In this way, game setbacks call on players to actually use their skills.

LEARNING OUTCOMES

The predefined learning objectives for JUMP are to increase the player's word knowledge by exposing him or her to approximately 500 vocabulary words over the course of 10 levels and to improve player use of word learning strategies by providing instruction and practice activities that target contextual and affix analysis. From the perspective of the player, the achievement of learning outcomes will be apparent as the player is able to progress from level to level, meeting the criteria required for game progression—criteria that are instructionally based.

In addition to the indications of progressions in-game, JUMP features a built-in assessment database that invisibly tracks each player's performance and dynamically offers review material specifically tailored to each player's needs. The back end database tracks when and how many times players are exposed to specific words, their performance answering assessment questions, and the number of exposures players needed before they retained the reading strategy or word definition. Data tracked is cumulative and can be viewed for each level. This information is available through an in-game menu.

FORM MEETS FUNCTION

Instructional content and game characteristics that the game industry recognizes as key to developing an engaging game experience have come together in JUMP to create an innovative educational game. JUMP strives to go beyond simply creating an electronic version of school; instead, JUMP creates a game environment in which the player participates in a mission to save Hugo (the best pet ever) and stop the evil Dr. Z and his sidekick robot, the maniacal Mr. Muffins, from taking over the galaxy. As the player engages in his or her quest, the game progression becomes the vehicle for interacting with words and learning strategies designed to support the struggling 4th grade reader. By embedding strong learning principles and educational goals in the areas of fantasy, rules/goals, sensory stimuli, challenge, mystery, and control, the game design of this RPG/adventure hybrid is activated within an instructional context to not only enhance, but promote, the player's learning process.

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