Epistemological Beliefs in Games vs. School: A Mixed-Methods Approach

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Abstract: This paper outlines a study examining whether adolescent videogame players hold different epistemological beliefs in the game space compared to their school realm. We presented a group of adolescent *World of Warcraft* players, a massively multiplayer online (MMO) game in which the participants play together to accomplish shared goals, with two isometric epistemological surveys (one regarding the game and the other regarding school) to determine whether there is a difference in their beliefs about the nature of knowledge and learning in game play compared to school. In triangulating the quantitative survey results with qualitative gameplay chat data, our results indicate that adolescent players are significantly more likely to believe that hard work is rewarded with learning and success in the context of the game, whereas in a school-based context players tended to believe the opposite: that one can't learn how to learn, and success is unrelated to hard work.

Introduction and Theoretical Framework

Leaders in education throughout the post-industrial era have questioned beliefs about the nature of knowledge. These epistemological explorations go back even as far as Dewey, who challenged the idea of science knowledge as simply a collection of fact (1910). Rather, he repeatedly cautioned against the teaching of science as just content rather than process. "The future of our civilization," he maintained, "depends upon the widening spread and deepening hold of the scientific habits of mind" (1910, p. 127). In the last few decades, Chinn and Malhotra and the American Association for the Advancement of Science have further reinforced the skill-based nature of science, delineating much scientific content as thinking processes and strategies for obtaining knowledge (Chinn and Malhotra, 2002; AAAS, 1993). Using this epistemological framework, recent research has shown evidence of scientific thinking in virtual worlds (Steinkuehler, 2008), specifically suggesting "social construction of knowledge", a scientific habit of mind based on the assertion that scientists construct knowledge in collaborative groups (AAAS.D.12.6 & 1.A.12.2; Chinn and Malhotra 2002).

Thus, Dewey's century old prophecy may be coming true—that in the new frontier of technologically-driven learning, it is the scientific thinking processes and habits of mind that persevere. But how else does his discussion of epistemological beliefs apply? Beyond the characteristics of the subject matter, epistemological beliefs of the learners themselves may well be fueling the very habits of mind that make for mastery of science, or any semiotic domain (Gee, 2003). For example, the scientific habits of mind found prevalent in online *World of Warcraft* (*WoW*) forums (Steinkuehler, 2008), demonstrates the kind of collective intelligence that is driven by the willing participation/contribution of its community members. In such a participant-driven learning community, the members' attitudes about their own potential to learn and share their knowledge (more formally known as epistemological beliefs) very likely contribute to their engagement in their community of practice (Lave & Wenger, 1991). Put simply, the members' epistemological beliefs can greatly affect their participation in (and therefore the success of) their own learning endeavors. Bandura discusses self-efficacy (1986) in similar terms, asserting that "what people think, believe, and feel affects how they behave," and that "the natural and extrinsic effects of their actions, in turn, partly determine their thought patterns and affective reactions" (p. 25). In previous studies, the impact of epistemological beliefs on academic performance has been well documented; Paulson & Feldman (1999) found that students who have a strong belief that the ability to learn is fixed at birth are less likely to engage in self-regulated learning strategies. They also found that students who believe strongly that learning happens either quickly or not-at-all are less likely to engage in elaborate study strategies. Schoenfeld (1983) found that students who believe learning takes place very quickly (and don't believe one can learn much over a longer time) are less likely to take on computation tasks in math that will take longer than a few minutes. In parallel, Steinkuehler (2008) found that in the body of *WoW* online forum data (in which 85% evidenced the desirable scientific habit of mind "social construction of knowledge"), 65% of the total forum posts demonstrated the positive epistemological belief that "knowledge is an open-ended process of evaluation and argument" (an epistemological statement adapted from Diane Kuhn (1992)). Therefore, the development of scientific habits of mind and cross-curricular problem-solving

approaches seem to have strong epistemological roots. Inspired by these findings—and intrigued by the seeming differences in attitudes about learning between traditional school environments and informal virtual worlds like WoW—our lab undertook a study specifically examining epistemological beliefs in school vs. games.

An Epistemological History

In the last 50 years, epistemology has grown from an emergent topic to a broadly researched field, in which various domains and demographics have been studied, and qualitative and quantitative instruments been developed. For our study, the research team chose a well-established quantitative assessment called the Epistemology Questionnaire (EQ), which was developed by Schommer (1998).

Schommer based much of her work on one of the first epistemological researchers, William Perry. In the 1950's, he initiated an official exploration of "epistemology" (1968). Surveying and interviewing Harvard undergraduates, Perry found that many first-year students believed that knowledge is simple, certain, and handed down by omniscient authority. By the end of their four years at Harvard, Perry found his subjects had undergone a series of evolutions in their epistemological beliefs—specifically, that many then believed knowledge is complex, tentative, and derived through reason and empirical evidence.

Following Perry, the work of Dweck and Leggett (1988) is especially relevant to this study, with their findings that "helpless individuals appear to focus on their ability and its adequacy (or inadequacy), mastery-oriented ones appear to focus on mastery through strategy and effort; whereas helpless individuals appear to view challenging problems as a threat to their self-esteem, mastery-oriented ones appear to view them as opportunities for learning something new" (p. 259). The "helpless" individuals were characterized as such because of their behavior in the face of their belief that ability to learn is fixed. It was this distinction of a "fixed ability" belief that served as an important precursor to Schommer's 1990 article—the work on which this study's surveys and assessment of survey data were based. Also influential in the 1980's was the work of Schoenfeld (1985), uncovering epistemological beliefs about the speed of learning, as well as the work of Baxter Magolda & Porterfield (1985) in developing epistemological assessments.

In "Effects of beliefs about the nature of knowledge on comprehension," published in 1990, Marlene Schommer offers the view that epistemological beliefs be conceived as multidimensional. She argues for four main categories of epistemological beliefs: "(a) stability of knowledge, ranging from never changing to always evolving; (b) structure of knowledge, ranging from isolated bits to highly interrelated concepts; (c) speed of learning, ranging from quick or not-at-all to gradual; and (d) ability to learn, ranging from fixed at birth to life-long improvement" (Schommer et al., 2003, p. 350). In this 1990 article, Schommer uses these four categories to develop a measurement central to this study: Schommer's Epistemology Questionnaire. The survey is structured around the four factors of stability of knowledge, structure of knowledge, speed of learning, and ability to learn. The purpose of the survey is to produce a quantitative measurement of the given person's epistemological beliefs in each category. A large reason she distinguishes these categories is because she believes each one to be more or less independent from one another in an individual. Schommer's 1993 publication continued her research with secondary school students, for whom the survey was originally intended. It was later refined for different ages of subjects, including an updated version (Schommer, 1998) based on her research on college age subjects (1997).

Methods

This study was conducted as part of a larger, two-year line of inquiry exploring the impact of a game-based casual learning lab on adolescent boys' literacy and learning. Twenty-two lab participants took part in the study total. All participants were male and between the ages of 13 to 18. The goal of the afterschool program was to leverage the boys' existing interest in videogames to strengthen their interest in literacy as a tool for problem solving, researching online information resources, and synthesizing in-game and out-of-game information. As part of this lab, participants and researchers played *WoW* together regularly online as fellow guild members (i.e. as part of an in-game group) and maintained a private online guild forum for out-of-game asynchronous discussions. In addition, the lab hosted Saturday monthly face-to-face meetings, which allowed for both group gaming and data collection, including participant observation, surveys, and studies. The study detailed here took place over a few such Saturday events.

There were two surveys given to the participants, both based directly off of Schommer's Epistemology Questionnaire (Schommer, 1998). Schommer's original survey is structured around four factors, which include stability of knowledge, structure of knowledge, speed of learning, and ability to learn. Each category is broken down into subsets; for example, the large category of "Speed of Learning" is broken down into subcategories "Learn the First Time," "Learning is Quick," and "Concentrated Effort is a Waste of Time." The survey is written with 63 items, asking the subject to rate their response to each item on a Likert scale from 1 to 5. A higher converted score on an item indicates a more "naïve" (limited or potentially harmful) belief about knowledge, whereas a lower final score on an item indicates a more "sophisticated" (constructive) belief about learning. In turn, each item fits into a subset of one of the larger categories.

4 FACTORS	12 SUBSETS	63 ITEMS (selected examples)*
Ability to Learn	Can't Learn How to Learn	- A course in study skills would probably be valuable.
	Success is Unrelated to Hard Work	- Genius is 10% ability and 90% hard work.
	Ability to Learn is Innate	+ Some people are born good learners, others are just stuck with limited ability.
Speed of Learning	Learn the First Time	+ Almost all the information you can learn from a textbook you will get during the first reading.
	Learning is Quick	- If a person can't understand something within a short amount of time, they should keep on trying.
	Concentrated Effort is a Waste of Time	+ If a person tries too hard to understand a problem, they will most likely end up being confused.
Structure of Knowledge	Seeks Single Answers	+The best thing about science courses is that most problems have only one right answer.
	Avoid Integration	- I try my best to combine information across chapters or even across classes.
	Avoid Ambiguity	+ It's a waste of time to work on problems which have no possibility of coming out with a clear-cut and unambiguous answer.
Stability of Knowledge	Knowledge is Certain	+ Truth is unchanging.
	Depend on Authority	- When you first encounter a difficult concept in a textbook, it's best to work it out on your own.
	Don't Criticize Authority	+ People who challenge authority are over-confident.

The symbol "-" indicates phrasing in terms of a sophisticated epistemological view; "+" indicates phrasing in terms of a naïve view.

***Table 1*: Structure of Original Schommer Epistemology Questionnaire (Schommer, 1990)**

The two surveys our research team gave the players were identical to Schommer's in structure, order, and items. To develop the games survey, we created an isomorphic survey item by item while changing the content of each item from school to games-related measures. We then checked validity by circulating the instrument among fifteen players who marked each item as good or bad and suggested edits. Once this member-checking phase was finished, we then grouped together the items based on the underlying factors they were intended to measure and checked to make sure that the item indeed still reflected the true spirit of the underlying construct. When that was confirmed, we put the items back in their original order.

Each survey had 63 items with identical structures mirroring the original. The surveys were given about 5 months apart. This was done purposely so that participants would have some gameplay experience as context by the time they took the games survey (prior school experience was a given, so no delay on the experiment timetable was necessary).

After gathering the group of boys, giving the spaced-out surveys, and recording eight months of chat data, the data collection phase was over. The next step involved quantitatively analyzing the epistemology surveys according to Schommer's guidelines and then finding any statistically significant differences between the participants' epistemological beliefs regarding school versus games. Then, using our quantitative results, we developed a series of qualitative codes and combed through the chat data in order to find excerpts related to our survey findings. Next was cleaning up the excerpts, removing lines of chat of research facilitators and players who had not taken the epistemology surveys. Lastly, the excerpt data was sorted, sequenced, and quantitatively grouped to show any significant patterns triangulating our quantitative survey data.

Results

After processing the raw survey data into final scaled scores (according to Schommer's instructions (1998)), paired-sample t-tests revealed significant differences between the game and school contexts on two subsets: "Success is unrelated to hard work" and "Can't Learn How to Learn" (see table 1). We then identified two major coding categories: Naïve and Sophisticated epistemological beliefs. Using the statistically significant subsets above, we were then able to create a distinct coding scheme (Chi, 1997) for the qualitative data: *can't learn how to learn (N1), success is unrelated to hard work (N2)*, *can learn how to learn (S1), success is related to hard work (S2).*

	(N) Naïve	**(S) Sophisticated**
(1) learning is unable / able to be learned	N1 *0%*	S1 *27%*
(2) success unrelated / related to hard work	N2 *5%*	S2 *68%*
% breakdown	*5%*	*95%*

***Table 2*: Graphic Organizer of Qualitative Codes**

The complete data set consisted of 454 photos, 66 forum posts, over 100 hours of video, and 2,506 pages of in-game chat logs. The data was analyzed with 11 themes and 44 codes, two of those were "nature of knowledge" and "nature of learning". The specialized epistemology codes from Table 2 were then applied to this secondary, smaller data corpus. After this coding, a simple percentage breakdown of excerpts per code revealed clear patterns. Excerpts expressing a naïve attitude about the nature of learning accounted only for 5% of the total, while amount of epistemological talk expressing a sophisticated view of accounted for 95% of the relevant chat corpus.

Discussion

Both the results from the players' surveys and the coded excerpts support the conclusion that learners tend to believe that success and learning are *achieved* abilities in games, and *fixed* abilities when it comes to school.

The differences between school vs. games context on "Can't Learn How to Learn" and "Success is Unrelated to Hard Work" subsets were statistically significant, with views significantly more "sophisticated" on the games survey than on the school survey. This signaled that the participants felt in *WoW* learning and success can be achieved through effort.

In terms of the qualitative data, sophisticated (rather than naïve) epistemological talk accounted for 95% of the relevant chat corpus. (Table 2) clearly supports patterns found within the survey data that players tend to believe in achieved learning and success in *WoW*. Corroborating this is the fact the naïve belief that one *can't learn how to learn* comprises 0% of all coded excerpts over 8 months of play. It is also interesting to note that the majority of coded excerpts (68%) pertained to *success is related to hard work*. One possible explanation is that success on an immediate goal in the naturalistic setting of gameplay may have been a highly concrete, relevant discussion topic.

In addition to the large proportion of "sophisticated" codes, the excerpts' progression over time supports the idea that epistemological beliefs about achieved ability are perpetuated by the game. The only fixed ability codes in the participants' excerpts appeared in early November (within the first two months of the study), suggesting that already sparse naïve epistemological beliefs may fade out as the gameplay progresses.

Individual excerpts from the players show promising evidence of their belief in achieved success and ability to learn in *WoW*. One player in particular got discouraged early on in the study—declaring in a glaring N2 (naïve) code, "idc [I don't care] I'm never gonna get this guy up to [level] 70". However, in the progression of the rest of the study, he had five different excerpts signaling his belief in achieved success (S2) and ability to learn (S1). "I got to lvl 80 so fast because someone said it was impossible," he announced in December, just two months after he had made his previous defeatist prediction. Other players discovered they could achieve progress in the game through hard work. One participant said "idk [I don't know] but when I focus I can level hella fast," echoing the sentiment of a fellow player who said that "yay!" he's "getting better" and that he really "like[d] learning new moves and stuff." Another participant, inspired by the gameplay, began a discussion with direct commentary on the human ability to learn: "A younger mind has greater plasticity of course but that doesn't mean that a greater/deeper context for information to placed into doesn't give its own advantage" (a resounding code S1).

Conclusions & Future Research

This epistemological study did support our original supposition that learners hold more constructive, sophisticated epistemological beliefs about games than they hold about school. In future research, a compelling direction would be to investigate specifically what about games triggers or sustains these sophisticated epistemological beliefs, and what triggers more pessimistic, naïve views in school. It would be interesting to attempt to separate the initial positive epistemological attitudes about games from the mechanisms that sustain them within the game. Finally, collecting a sampling of classroom chat data to parallel the *WoW* chat data, and coding it using qualitative codes, could yield relevant information. Ultimately, though, this study was fascinating because it helped to quantify something we intuitively suspected: that for players of *World of Warcraft*, the results of hard work and repeated attempts to learn are extremely rewarding. In other words, in that gaming context, learning was intrinsically rewarding and motivating—something educators strive to tap into every day in their own classrooms.

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