The Game Ontology Project: Supporting Learning While Contributing Authentically to Game Studies

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Abstract: Learning research has argued the importance of providing authentic contexts for learning. However, traditional learning environments are often disconnected from external communities of practice. For example, students might design and carry out scientific experiments that are valuable pedagogically, but do not contribute to science itself. In this study, we used the Game Ontology Project (GOP), a wiki-enabled hierarchy of elements of gameplay used by games studies researchers, in a game design class. Students found it useful for learning. However, encouraging sustained participation was challenging because students tended to view the GOP as a static source, rather than a participatory and editable resource. Expert analysis of the student's contributions to the ontology found them to be useful and significant. We conclude with thoughts on the importance of these kinds of authentic environments in traditional learning.

Introduction

Learning research has argued the importance of providing students with an authentic context for fostering learning (Shaffer & Resnick, 1999). For example, project-based inquiry science (e.g., Blumenfeld et al., 1991), has focused on ensuring that what students do in the classroom somehow reflects or recreates some aspect of the real world outside of the learning environment. Others help learners interact with subject matter experts or non-school members who can serve as mentors, share knowledge, or answer questions (Ellis & Bruckman, 2002; O'Neill & Gomez, 1998; Songer, 1996). It has also been argued that using the tools and methods of a discipline encourages learning in that community of practice (Lave & Wenger, 1991). For example, students should learn history by "making history" as professional historians do (Kobrin et al., 1993) or engage with mathematical problems as mathematicians (D'Ambrosio, 1995). However, most learning in traditional environments is disconnected from external communities of practice and disciplines. For example, students might design and carry out scientific experiments that while valuable pedagogically, do not contribute to science itself. Allowing students to meaningfully participate in authentic practices that contribute to a larger body of knowledge is difficult for a variety of reasons. For instance, real-world science is often not accessible to students because authentic activities that are interesting to students are too open-ended and require content knowledge and scientific thinking that students do not have the supports to realize (Edelson, 1998).

If we understand learning as a process of transformation of participation (Rogoff, 1994), of both absorbing and being absorbed in a "culture of practice", the lack of meaningful connections between novices (students) and larger communities of practice (experts, scientists, etc.) can be problematic. Lave and Wenger (1991) describe how learning occurs through legitimate peripheral participation (LPP). LPP describes how novice members of a community often begin participating in peripheral tasks that contribute to the goals of the community. These activities, while typically simple, are valued and important to the community as a whole (Lave & Wenger, 1991). Thus, how we can design learning environments that: 1) are approachable to learners, 2) allow learners to contribute legitimately to external communities of practice, 3) support visibility and access to the practices of a broader community?

This article describes how a research project used by members of the field of game studies was integrated with a university-level games class so as to help students learn and develop a critical vocabulary for talking about games while providing them with the opportunity to meaningfully, and authentically, contribute to the emergent field of game studies. We will outline how this particular games studies project and the technology on which it was implemented scaffolded and afforded the exploration, reflection, discussion, and contribution of concepts and terminology related to videogames. Our analysis also includes the evaluation by games studies experts on the quality, type, and role played by the students' contributions. Finally, the results of this experience, both positive and negative, help frame our discussion of unsolved issues as well as future directions.

Background

Challenges of Studying Games

Students taking games classes are often challenged by issues surrounding the lack of critical vocabulary for talking about games (Zagal & Bruckman, 2007). Among other things, despite years of experience playing games, students often have difficulties articulating and expressing ideas about games and gameplay. Although they often have a good feel for gameplay aspects, they find it challenging to describe what these aspects are, and how they interact with each other to produce a game experience. When asked to provide in-depth game analyses, students often dwell on superficial features of games and use a language and style modeled after game reviews from mainstream games journalism. Unfortunately, game reviews, which are written to help consumers decide whether or not they want to purchase a certain game, are a poor model for the kinds of critical writing they are expected to do for class. Also, students lack the vocabulary for understanding, and describing, what happens when they play games (Zagal & Bruckman, 2007).

These issues are perhaps unsurprising due to the relative youth of the videogame industry. In fact, game designers have also called for a design language (Church, 1999; Kreimeier, 2002), noting that designers currently lack a unified vocabulary for describing existing games and thinking through the design of new ones. Many of the proposed approaches focus on offering aid to the designer, either in the form of design patterns (Björk & Holopainen, 2005), which name and describe design elements, or in the closely-related notion of design rules, which offer advice and guidelines for specific design situations (Falstein, 2004). These approaches are constantly evolving, growing, and adapting to the ever-changing landscape of videogames. The ever-growing size of collections of gameplay design patterns, design rules, or terminology can be daunting to students who can easily feel overwhelmed and not know from where to start.

Game Ontology Project

The Game Ontology Project is developing a game ontology that identifies the important structural elements of games and the relationships between them, organizing them hierarchically (Zagal et al., 2007). The term ontology is borrowed from computer science, and refers to the identification and (oftentimes formal) description of entities within a domain. Often, the ontological elements are derived from common game terminology (e.g. level and score) and are then refined by both abstracting more general concepts and by identifying more precise or specific concepts.

Each ontology entry consists of a title or name, a description of the element, examples of games that embody the element, a parent element, potentially one or more child elements, and potentially one or more part elements (elements related by the part-of relation). The examples describe how the element is instantiated in specific games. There are two types of examples, strong and weak. Strong examples are "obvious" or canonical exemplars of a particular entry, while weak examples describe borderline cases of games that partially reify the element. Table 1 shows an example of a particular ontology entry called "To Own".

Table 1: Example Ontology Entry - "To Own".

Name	To Own
Parent	Entity Manipulation
Children	To Capture, To Possess, To Exchange
Description	Entities can own other game entities. Ownership does not carry any inherent meaning, other than the fact that one entity is tied to another. Changes in ownership can not be initiated by the owned entity. Ownership can change the attributes or abilities of either the owned or owning entity. Ownership can be used to measure performance, either positive or negative. Ownership is never permanent; the possibility of losing ownership separates ownership from an inherent attribute or ability of an entity. Ownership of an entity can change in variety of ways, including voluntary and involuntary changes of ownership. It is important to note the difference between owning an entity, and using an entity. For example, in *Super Mario Bros*, when Mario collides with a mushroom, the mushroom is immediately used and removed from the game world. Mario never owns the mushroom.
Strong Example	In *Super Mario World,* Mario can collect mushrooms (or fire flowers or feathers) to use later. Mario owns these entities and can choose when to use them.
Weak Example	In *Ico*, the player character must protect a girl called Yorda. While the player only directly controls Ico, his actions are very closely tied to leading, guiding and protecting Yorda. One could argue that Ico, in effect, owns Yorda because of the way they are tied to each other.

The Game Ontology is a tool developed and used by academic games researchers. Its primary function is to serve as a framework for exploring research questions related to games. It also contributes a vocabulary for analyzing and critiquing games. It currently consists of more than 190 elements at varying levels of abstraction. The Game Ontology is publicly available, and editable on a wiki-enabled website (see www.gameontology.org).

Affordances for Authentic Learning and Legitimate Participation

We hypothesized that the Game Ontology Project, used in the context of a games class, provided a unique opportunity for students to not only learn and acquire a critical vocabulary about games but also to participate in the creation of new knowledge about games. In particular, we felt that the structure and organization of the ontology together with some affordances of the technology on which it resides would be valuable for learning.

Game Ontology Project Affordances

As described earlier, the GOP distinguishes itself from other games studies approaches due to its reliance on strong and weak examples as well as its hierarchical approach. By relying on strong, or canonical, and weak or borderline examples, the GOP affords the exploration of the space of game design. Distinctions aren't binary, leaving ample room for discussion and revisitation. The ontology's reliance on examples also provides a clear entry point for students to legitimately and peripherally participate. Students could leverage their own personal knowledge by adding examples from games they are familiar while also refining those that already exist. In this way, students can begin to associate what they know about games with the knowledge created in the GOP as well as identify those things they may know implicitly.

The GOP can be characterized as a knowledge building endeavour. Knowledge building is a process by which ideas that are valuable to a community are continually produced and improved. For example, doctors working to cure cancer are knowledge builders engaged in a knowledge building community. Their collective goal is to advance the frontiers of knowledge as they perceive them. As they report their findings to each other and discuss their implications, they create and modify (as a community) public knowledge about their field. The result of knowledge building is the creation and modification of public knowledge-- knowledge that lives "in the world" and is available to be worked on and used by other people (Scardamalia & Bereiter, 2002).

Scardamalia and Bereiter (1991) have taken this idea into the realm of formal learning by proposing knowledge building activities as a way of altering discourse patterns in the classroom so that students would assume what they called "higher levels of agency". The core elements of successful knowledge building are ideas as objects to think with, ideas as improvable and idea diversity. As learners better understand the problems and questions they are exploring, these ideas change and improve. Knowledge building systems also require a critical mass of articulated ideas before they become useful. The GOP provides an existing structure and content that serves to mitigate this challenge. The existing content thus scaffolds knowledge building by providing a guide for what entries should look like, and how they are structured and organized.

Knowledge building discourse is decentralized with a focus on collective knowledge. The knowledge of those who are more advanced does not circumscribe what is to be learned or investigated and novices push discourse towards definition and clarification. In the case of games, not everyone is an expert in every game. Thus, there is room for everyone to provide their own examples and knowledge. Also, the non-static nature of the entries implies that anyone can provide examples that push discourse towards refining and clarifying entries. It is often the case in the GOP that when an entry has too many weak examples its definition either needs to be refined or a new sub-entry needs to be created for which those weak examples become strong examples.

Knowledge building discourse should interact productively within more broadly conceived knowledge building communities. Students using the GOP have the opportunity to interact, contribute and participate directly of an on-going project that is active and used by games studies researchers. In this sense, their contributions are not isolated or in a vacuum. In summary, for students, the GOP facilitates:

- Leveraging the use of personal knowledge of games
- Browsing and learning by incorporating varying levels of abstraction
- An environment focused on discourse where knowledge is continually refined and improved

Wiki-Related Affordances

The GOP currently resides on a wiki-enable wesite. A wiki is a type of website that allows users to easily add and edit content (Leuf & Cunningham, 2001). It is a simplification of the process of creating HTML web pages combined with a system that records each individual change that occurs over time, so that at any time, a page can be reverted to any of its previous states. A wiki system thus allows anyone with a web browser to easily edit, write and create webpages.

The GOP uses Mediawiki, the same technology used by Wikipedia. Wikipedia, a popular end-user editable online encyclopedia, can be considered an example of a knowledge building environment and is among the most prolific collaborative authoring projects ever sustained in an online environment (Bryant et al., 2005). It's success as a knowledge building tool can be partly explained by certain features normally absent in other wiki implementations. Mediawiki allows registered users to maintain "watchlists" of pages they wish to pay attention to. Users are notified whenever a page on their watchlist is edited. This feature allows users to "keep track" of the changes that a page might go through. Another feature is the talk page. Talk pages are secondary webpages, one for each primary page, where users can discuss issues surrounding the topics of the primary pages. Should certain content be added, deleted, or moved elsewhere? Talk pages support the process of knowledge building by providing a space for users to discuss the knowledge they are creating. Also, novice users can use these pages to understand the evolution of a certain page and understand how consensus was achieved regarding the current state of a page.

The medium of knowledge building discussions is important. Features such as talk pages and watchlists help mitigate many of the challenges to knowledge building such as dealing with conceptual discussions that are "left in the air" (Cummings, 2003). Talk pages are also different from threaded discussions, which can be problematic since they have no systematic way of promoting convergence of ideas (Stahl, 2001). In the case of Wikipedia, some researchers hypothesize its success lies in how it encourages community introspection: it is strongly designed so that members watch each other, talk about each other's contributions, and directly address the fact that they must reach consensus (Viegas et al., 2004). In this sense, novices to the Game Ontology have direct access to the practices, discussions, and reasoning of the games studies researchers that use it. Having the Game Ontology on a wiki-enabled web site also provides opportunities for people outside of the project to easily participate. There are many legitimate opportunities to help build knowledge in the ontology. Not only are there numerous entries that are lacking in depth and examples, but there are also entire areas that haven't been explored. In summary, the technology platform supporting the GOP affords knowledge building by:

- Providing separate spaces for content and content discussion
- Providing visibility to the discussions and process behind the creation of content
- Helping users keep track of content they are involved in

Study

In early 2007, the Game Ontology was used as part of the regular curriculum in an introductory game design class. The class was an undergraduate lecture-style class with over 200 hundred students. In the class, students were required to play and design games, read scholarly articles, and turn in written assignments. Participants were recruited at the beginning of the term.

Data Collection and Analysis

As part of their regular coursework students were introduced to some terminology from the GOP. Three weeks later students were asked to complete a game ontology assignment. For the assignment students had to pick two games they knew well. Then they had to find entries in the ontology and edit them in such a way as to add those games as examples (strong or weak). Students had to edit at least two entries (ex: game A as a strong example of one entry and weak example on another, and vice versa for game B), but they could edit up to four different entries. The only additional restriction was that at least two of the examples should be added to entries under the "Rules" sub-hierarchy.

Students were graded only on the completion of the assignment. Because it is often the case that disagreements about examples has lead to the refinement of the ontology, grading did not focus on the correctness of the examples. Additionally, students were offered the possibility of extra credit for participation that went above and beyond the assignment requirements such as meaningful contributions to existing entries, proposing new entries, and participating in discussions on the talk page. The researchers were not involved in the assessment though they did participate in the discussions that took place on the ontology wiki pages. The duration of the assignment was officially one week, though students could begin their participation sooner.

A total of 381 edits were made by 49 study participants. Edits varied from very minor (one or two characters, such as when correcting a typo) to one or two paragraphs in length. In total, 65 different ontology entries were edited and participants contributed a total of 128 different examples. Additionally, we conducted interviews with sixteen students, three of the teaching assistants, and the instructor. As recommended for qualitative research (Glaser & Strauss, 1967), we employ theoretical sampling in which cases are chosen based on theoretical (developed a priori) categories to provide polar types, rather than for statistical generalizability to a larger population (Eisenhardt, 1989). Interview subjects were selected based on their level of prior experience with games (novice, intermediate, gamer) and participation on the GOP (minimum required, active participation). All interviews were audio-recorded and transcribed. In addition to asking students about their experience participating in the ontology, our interview protocol includes questions about potential challenges of learning about games. The student protocol also includes open-ended questions about their expectations regarding the course and changes they would make to the assignments. Interviews were semi-structured to ensure that all participants are asked certain questions yet still allow them to raise other issues they feel are relevant. Data from the interviews was used to contextualize and provide additional insight to the analysis of the student participation. All interviewee names appearing in this article have been changed for reasons of privacy.

We also analyzed the quality of contributions made by the students. Three subject matter experts, all with prior experience working on the Game Ontology Project, were asked to evaluate a random selection of examples written by the students. The goal of this evaluation was to determine whether or not their contributions were valuable, ie. should the example remain in the ontology? We also wanted to get a sense of how these contributions could be characterized. Of the 128 examples written, the experts evaluated a randomly selected sample of 96. Assuming a normal distribution, this sample size is representative of the larger population for a 95% confidence level and 5% margin of error. Each expert independently reviewed 32 different examples. Additionally, for purposes of calculating interrater reliability, a separate random sample of ten examples was independently evaluated by all three experts. As recommended by Lombard et al, two indices were selected to determine interrater reliability (2002). In terms of percent of agreement, two of the three raters agreed 100% of the time and all three agreed 60% of the time. Fleiss' kappa (1971) was calculated as 0.87, a value considered acceptable in this case (Lombard et al., 2002).

Results

Overall effects and Student Perception

In general, the students were positive about the role they felt the GOP played in the context of the class. Anne felt that "it was a good assignment because it really made you think and try and really think about the aspects of the games you had played." For the majority of the students, the ontology was a source of definitions. Bert describes how "there were a lot of times where [the instructor] would just be rattling away all these terms and I would be a little bit scared in my seat and I would write down what I didn't understand and I would go home and check it out." Many of these students didn't perceive the GOP as a "living" source with definitions that could be debated, edited and improved. On the other hand, some students found that using the GOP broadened their understanding of games. Frank notes that "I didn't really think about games along those terms before and it was nice to have a new perspective on games." Understanding games as the combinations of structural elements of gameplay was novel to them. Anne comments how she "thought the categories were really interesting. I hadn't thought about the breakdown of games before so I really liked that." Finally, some students felt it was helpful to them in the context of their game design projects. Joe felt that "when you're making a game there a lot of choices you have to make and knowing your options made your choices clearer."

Students also perceived the assignment as a legitimate activity and realized that their participation on the ontology would be visible to people outside of the class as well as the games researchers that regularly worked on the ontology. They realized they were making changes and adding content to a public resource and that their work had consequences beyond the assignment. Mary notes how "I was sort of worried about putting something in that wouldn't fit because it is an editable site and so I would put something in and it would be like...oh that's really wrong, I'm going to mess things up for the game researchers." Mike, on the other hand, describes how he was concerned with the correctness of his examples because "if somebody were to have put things in categories that they didn't belong…and they weren't corrected, then they might have learned to opposite of what's true."

Navigation and Participation

We hypothesized that the hierarchical structure would prove beneficial to the student's participation and understanding of the ontology. For many students, this was in fact their primary way of browsing the ontology and they often started with the entries suggested by the instructor. However, we found evidence of other popular ways of navigating. Dave describes how "there's a list sorted by alphabetical order and I just looked through which ones looked more interesting to me" while Chris opted to "just randomly bring a page, just any random page. And this is how I navigated through that because I wasn't really sure what I wanted to add." In addition to a hierarchical style of navigation, students made use of random and indexed navigation.

The choice of navigation is tied to the way that students approached the task of adding strong and weak examples. Some students approached the game ontology with a specific game in mind and then tried to identify entries for which they could use that game as an example (strong or weak). The other approach was to start from an entry they found particularly interesting or compelling and then try to come up with examples (weak and strong) for it. Students with a game in mind favored indexed and random navigation while those focused on the entries found the hierarchical scheme more useful.

We also hypothesized that the use of strong and weak examples would prompt students to reflect on games at a deeper level. Tom discusses how the game Oblivion forced him to explore some issues more deeply, "It was really challenging to come up with specifically strong and weak examples of things because there were some of them that you could come up with gray areas for. In Oblivion, depending on which version of the game you have, you may get a strong ending or a world exhaustion [referring to the entry "Game Ends" and its child entry "Gameworld Exhaustion"], because if you have the PC version you could download more pieces or more modules to increase your game time and those are all part of the world so in a sense, the world never really ends." In this sense, the use of strong and weak examples in the ontology helped some students think more deeply about the entries and how they relate to what they see in certain games. In particular, the achieved a more nuanced understanding. While coming up with strong examples, was generally considered easy by most students, having to identify weak examples and justify their reasoning elicited greater reflection and discussion.

Challenges

There are many barriers to eliciting participation and collaboration on wiki environments (Guzdial et al., 2002) and our study was not the exception. Many students were not familiar with wikis and the features offered by Mediawiki. This confusion led them to erroneously believe that removing content from a page would affect the teaching assistants' ability to grade the assignments. When asked why he didn't edit other people's contributions, Chris comments how "if somebody had put that there and that was their contribution then it might not be a good idea to move it for the sake of their grade, if I moved it, it would look like they didn't put something." Also, only having one assignment probably limited the possibilities of students engaging more with the discussions surrounding the entry definitions and value of certain examples. For many students, completing the assignment was an issue of "fire and forget" as there was little incentive to return to the ontology, read what their classmates may have added and possibly refine the knowledge created on the site.

There is room for improvement. For example, the assignment could be changed to encourage continued participation. Another approach could be to try similar, but shorter, assignments and have students engage with the GOP more fully over the whole of the course. A broader issue to address is helping students move from viewing knowledge as something static and "given," rather than something that they can help create and define.

Contribution to Game Studies

The expert evaluation of the examples written by the students was quite positive. The experts determined that 60% of the examples should remain in the ontology while only 14.5% should be removed. For the remaining examples (25.5%) the experts were ambivalent. Most of the examples, including those the experts were ambivalent about, could benefit from further proofreading and editing. Others could be improved by providing further information that better contextualizes the example with respect to the entry where it appears. For instance, one expert notes, for an example added to the "Boss Challenge" entry, how "[I] would like a little more detail on the structure of the 'town' and 'gym leader' situation for those of us who are Pokémon-challenged. I'm guessing you fight people in the town and work your way up to the "gym leader" boss." Other examples could benefit from the removal of unnecessary commentary or editorial such as the opinion of the relative merits of a game over its sequel. "There's valuable info here, just a little noise around the signal" notes one of the experts. The expert reviewers also found some examples (10% of all examples) that should be changed from strong examples to weak examples or vice versa.

The results of the evaluation were also positive even when considering only those examples that should be removed. Few examples were considered "non-salvageable" (only 6% of all examples) because they were incorrect or did not apply to the particular ontology entry where they were included. More than half (56%) of those examples evaluated as "should be removed" were considered relevant, but not worth the effort to correct. One of the experts noted how "sometimes the students didn't seem to find the right words and simply explained the examples very poorly. I found 2 types of 'bad' examples, the least of these were those that were not relevant. Most were relevant but poorly explained."

When characterizing the contribution made by the examples added by the students, perhaps the single most common feature was that the example helped add variety to the ontology (46% of all examples). This can mean referring to a game that many people have played or know about (46% of all examples), thus making the entry more accessible. When trying to understand a particular entry, it is helpful to have a variety of examples that refer to well-known or popular games so that people are likely to find a game they can relate their personal experiences to. Variety was also increased through the addition of examples that refer to games that are unusual or rare, yet still important for people to know about (12% of all examples). In this case, the example can help broaden students understanding by drawing attention to games they might not have heard about, or considered playing, otherwise. Many of these "rare" games are interesting, from a games studies perspective, because they can help illustrate the nuances and varying interpretations that an ontological entry can have (Zagal et al., 2007).

As described previously, the majority of the examples provided by the students served as direct contributions to the body of knowledge that is the game ontology. However, students' examples also contributed indirectly. The expert evaluators noted that some examples (5%) helped them realize something they hadn't noticed or thought about previously. Also, 9.1% of the examples helped the experts notice something about the ontology entry that needed to improve or be expanded upon. For example, in the entry "Games Ends" one of the students added a weak example referring to the game Pac-Man. Pac-Man, in theory, does not have a formal ending (you can't win, it just gets harder and harder until you lose). However, there is a notorious technical issue that causes the game to crash when the player reaches the 256th screen (Sellers, 2001). The student-provided example draws attention to an issue that was not considered in the original entry (game ends due to technical issue) and made him wonder if the entry should be modified to account for this. Another example, this time for the ontology entry “Agent Goals”, made an expert realize an implicit bias in the entry. “The way the entry is written, it sounds like we're talking about states in state machine AI. What we're getting at in the end here is that AI controlled agents have a prioritized set of goals that they seek to fulfill (like a hierarchical goal tree and the agents can switch modes between those goals according to the hierarchy of the goal tree)?” The entry, as written, implicitly assumes certain details about how agent goals are implemented in videogames and the expert wonders whether or not we want to leave the entry with that bias.

Student examples also served as a catalyst for reflection on broader issues of the game ontology. Experts indicated that 2.7% of the examples helped them think about something that should be added to another part of the ontology. These examples drew attention to future areas of growth for the ontology including new directions to pursue or new entries that should be added. In other words, student participation was more than just an “efficient” way of generating new examples, it also helped propel experts’ thinking in new directions. In summary, we are confident in stating that the students’ contribution to the ontology was not only useful to them, pedagogically speaking, but can also be fairly characterized as a legitimate contribution, both direct and indirect, to a body of knowledge that is part of the academic field of games studies.

Discussion and Future Directions

We began this research considering how to make the GOP, and the terms and concepts it describes, approachable and useful to students. We also wanted to help students leverage knowledge they have about videogames. From that perspective, we believe this experience was a success. Many students chose to participate beyond the minimum requirement. For instance, 28% of the students used more than two games and 34% edited more than four ontology entries. The GOP was approachable to the students and they also felt it played an important role in the context of their games education in general. Fran describes how “if you're going to study game design it’s important to have standardized terminology. I think that with the game ontology wiki it's interesting that you standardize terms and that you have many specific examples for each term and that's very important in terms of understanding the different parts that make a game or different aspects from different games.” We also wondered if the student contributions would be meaningful, or useful, to the game ontology project itself. On this point, we feel that we have succeeded in providing a learning environment where students were able to legitimately contribute to an emergent field of study.

However, the students’ misperception of the game ontology as a static and monolithic source is an issue that needs further exploration. In particular, we wonder if having students provide examples only reinforced the definitions provided in the ontology rather than encouraging them to challenge those definitions. Student provided examples helped the subject matter experts reflect and think in new directions; however this is something that ideally the students should also engage in. Further work is required to look at how to achieve the delicate balance between reinforcing and building upon existing ideas and challenging the status quo in such a way as to promote new ideas. Also, it is not clear to us how many students participated less due to concerns of “messing things up.” In this sense, the legitimacy and authenticity of the assignment may have also acted as a barrier to participation.

Finally, there is an issue regarding the sustainability, and scalability. Are the positive results of this experience the result of students being able to take advantage of the “low-hanging fruit”? If we were to repeat this experience, how many entries would become saturated with a too many similar examples that only marginally help illustrate an entry? This concern can be addressed by making changes to the structure of the game ontology to support larger numbers of examples or provide users with tools to filter the information provided. Users could filter the examples for an entry so as to only display examples that refer to games for a certain hardware platform or display examples of games released after a certain year. However, the nature of the medium also helps mitigate the “too many examples” problem. Older games are frequently unknown to younger students and are also often inaccessible due to technical reasons such as hardware obsolescence. The Game Ontology Project will always need to update the examples in order to remain accessible and understandable to its users as well as allow for new games to force the re-evaluation of existing entries.

In summary, we feel that our experience shows that it is possible to design learning environments that are approachable to learners, allow them to contribute legitimately to external communities of practice, and support visibility and access to the practices of a broader community. However, careful consideration should be made of the affordances of the technologies used together with those of the practices of the broader community in which one wishes students to participate in order that students can effectively engage in practices that are meaningful to them as well as the broader community.

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