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Designing FunWritr: unpacking an affinity-based, professionalizing, graduate-level educational technology design experience

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Abstract: In this paper and presentation we describe, unpack, and reflect upon the dynamic, evolving processes of collaborative, democratized educational technology design that led to the creation of an open-ended literacy development and language acquisition environment named FunWritr. When the project began, each member of our group was either in a graduate program for educational technology design or interested in matriculating into such a program. Over the course of five years we have worked together, growing as designers, developers, and researchers of educational technologies. Reflecting on our authentic, self-guided, evolving curriculum of experiences, we recognize processes and unpack factors that contributed to our growth and evolving philosophy of affinity-based, collaborative, sustainable, educational technology design. In describing and theorizing about our experiences and outcomes we have come to understand avenues for cultivating growth in design education that go beyond classrooms, fixed hierarchies, grades, and semester-based projects. Our interactions have led us to identify and theorize about six interrelated guiding design parameters for educational technology creation.

Keywords: design, technology, affinity-based, education, student-led

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Introduction

The field of Educational technology (ET) looks into the efficacy of various technologies to overcome challenges new and old in formal and informal educational environments. When novel approaches to meeting such challenges are desired, groups of ET designers and researchers take up the call to create, implement, and evaluate new technologies leveraged for educational purposes (Barab, Thomas, Dodge, Squire, & Newell, 2004). These are complicated, time and resource intensive undertakings that are rarely realized by a lone individual. Such endeavors often demand a team of designers, educators, developers, and researchers working collaboratively over extended periods on a wide range of tasks (Akerlind, 2005; Campbell, Schwier, & Kenny, 2009; Hung, Smith, Harris, & Lockard, 2010; Tracey, 2009). ET design groups such as these are often initiated and spearheaded by university faculty members who are able to bring sufficient resources, credibility, experience, and leadership to bear on the ambitious endeavor of ET design. Graduate students in ET programs typically participate in these types of research and design projects –in doing so they gain valuable insight and experience in an array of activities related to creating ET in addition to learning about the process of successfully disseminating findings. Unfortunately, not all graduate students are able to participate in traditional research groups due to a lack of access, scheduling mismatches, work or family responsibilities. Additionally a lack of technical expertise or research experience may preclude others from being invited to join projects. Furthermore some graduate students may demur membership in established groups due to differences in interest and/or epistemology.

Those who are able to join existing research groups often have less control over the direction of the research than they may like, they also may not be able to self-select their role within the group. Student member diversity in faculty-led research groups is largely up to the faculty member; also the range of research/design endeavors assigned to a specific student member is often largely determined by the faculty member in charge. Additionally, entering research led by a seasoned faculty member can be intimidating to the graduate student who is just entering research. In our case, we feel that the type of student-led, affinity-based group we created and continue to maintain affords a more democratized atmosphere wherein the process of and responsibility for carrying out the tasks of the research group is the responsibility of those members interested in getting it done. Student-led affinity-based groups offer their participants the chance to both lead and collaborate in academic and scholarly experimentation, growth, and wayfaring.

A literature review reveals that while a few studies have inquired into research related to computer-supported collaboration (see Johnson & Johnson, 1989; Stahl, 2005; Streeck & Mehus, 2003), research into student-initiated and led affinity-groups for education technology research and design are scarce with the most relevant and recent articulation of this construct coming from the field of computer engineering (Gates et al., 2009). In our paper, we seek to build upon existing scholarship by juxtaposing our experience and findings with the Affinity Research Group Model (Gates et al., 2009).

Our group, the Language Learning and Technology Research and Design group [LLTRDg] shares some attributes with the student affinity group model (SAGm) in that like the SAGm we articulated attainable, pre-determined objectives, we met outside of class periods, we worked to build and maintain a group culture, and we endeavored to work together toward the attainment of the objectives we set. Additionally, we point to

open communication, teamwork skills, existing research experience, and some existing technical skills as factors that played important roles in supporting both our overall group success as well as group success within the SAGm. However, in contrast to the SAG model, our level of contact with and ties to non-student mentors and role models was less formalized and more task-specific than in the SAGm.

Group Genesis, Maintenance, and Activities

Began in 2007, the LLTRDg is comprised mostly of current and former Instructional Technology PhD and Masters students in the University of Texas at Austin's Curriculum and Instruction department. Over the past five years, we have explored the ways computer technology (esp. natural language processing and unbundled APIs) can be leveraged to support language learning and literacy growth via collaboration and play via a design project that began by questioning the dominant narratives about the role of ET design being that of innovating at the pedagogical and not curricular level. Over time the FunWritr project emerged from our meeting to constitute our first and ongoing ET research and design endeavor. In the subsections below we break group formation and activities into different periods.

Period 1: Genesis (Oct. 2007-Oct. 2008)

In the Fall of 2007 one future member of the group sent out an email inviting other interested members of the UT-Austin ET community to meet to discuss ideas for designing language learning tools. At the time the long term viability of this group was in doubt as the group was exploratory. Three people met every few weeks during the semester to determine areas of mutual interest within educational technology and language learning. By August of the next year the two remaining members put out a call welcoming new members. Two incoming IT master's students joined and we established a weekly meeting time spending several weeks sharing our interests, previous teaching experiences, and favorite language learning resources with each other in order to build mutual understanding, a sense of community, and direction.

Period 2: Growth, Direction and Effort (Nov. 2008-Mar. 2009)

This phase was characterized by growth, direction, and effort. First, we came to a general consensus that we should begin work on the design of an application for language and literacy development that had been brought forward by one of the groups founding members. Second, we spent time articulating the ideas that made up this design opportunity and presented our initial thoughts at an Instructional Technology Department Brown Bag meeting as well as at a Doctoral Seminar for the Department of Language and Literacy both at the University of Texas. These two opportunities to tell others about our ideas and plans served as an initial catalyst for group effort and direction. Third, our presentations and word-of-mouth worked to create interest in others for joining the group, which had grown from 2 people at the beginning of the year to six. During this time we also drew on the ADDIE (analysis, design, development, implementation, and reevaluation) model for design as well as from the tradition of design-based research (Wang & Hannafin, 2005). Design-based research also helped us maintain a focus on theorizing about design as well as our collaborative design processes.

Period 3: IRBs, Conferences, and Growth (Apr. 2009-Aug. 2009)

As a group, we spent the late spring through late summer of 2009 using presentation proposals as a way to further externalize and detail our technology creation ideas. These efforts were done as not only a way to further articulate our design but also to meet the interests of the group's membership, many of whom had stated an interest in presenting at conferences. Part of the approach to determining what would get done was to require that any task not only hold the potential to advance the larger ET design project but also the task had to offer a some of the members carrying it out the chance to grow as designers, researchers, and/or developers. In this way, even if the conference proposal or design documents were rejected or went unused, the experience of creating them held value for group members. So, while our initial conference proposal submissions were not accepted, other tasks that held opportunities for growth as well as project advancement such as the creation of our research design and request to conduct research in a local school were accepted. By the end of August 2009 we were ready to begin pre-implementation classroom observations and advance our ET design project from a mocked-up idea to alpha/beta application design and development. Additionally, we added two members, both master's students in Instructional Technology at the University of Texas at Austin.

Period 4: Research with an Eye on Design, Design with an Eye Toward Research (Sept. 2009-April. 2011)

By the early Fall of 2009 our ET design idea, now called FunWritr, had an approved IRB to conduct research in a local elementary school to better understand the creative and participatory practices that go on in public school classrooms. We felt this type of research would support our design efforts even as the design and development work we began in this period would eventually allow us to conduct research in classrooms on the design of the software. In order to undertake preliminary data collection as well as application design and development, we began holding two different weekly meetings, one for the research endeavor and one for development. Some group members attended both meetings and others based their attendance on availability, interest, and goals, keeping abreast of developments both groups via a shared listserv. During the Fall of 2009 members of the research arm of the group spent 18 hours observing during language arts, center, and computer lab periods –making notes or jottings and later expanding them into fieldnotes (Emerson, 1995) before analyzing them together in an iterative, comparative fashion (Anfara, Brown, & Mangione, 2002; Strauss & Corbin, 1998). The pre-implementation research we conducted was carried out both in hopes of informing our design (Barab et al., 2004) as well as in the spirit of interest in contributing to what the field of ET know about technology's role in impacting creative and participatory literacy practices in public elementary school classrooms. More than this however, these dual-role efforts also allowed members of our group to gain insight into working on research and design projects whether the ET design idea was realized or not. On the design and development side, we recruited three interns from the university's computer science program to work with us. As with our ET design affinity members we worked to understand what the individual interests and goals these three interns had in order to ensure that they were able to accomplish these goals even as they worked with us to realize the development of our FunWritr design. Two of the three worked on the client side of design and development while one other individual

worked on database design and server side development. Two of these three interns worked with us for multiple semesters, and one continues to work with us after his graduation from the UT CS master's program.

Period 5: Refactoring, and Theorizing about ET Design Education (May 2011-Oct. 2012)

The resultant application which emerged from the efforts during period four, while encouraging, were not scalable. We have entered and remain in a cycle of server-side-code refactoring on the design and development side. Also during this time we engaged in several efforts to better understand what we have learned from this sustained, multifaceted, group ET design endeavor. With an eye on understanding both the nature of our ET design group as well as the nature of ET design, we went through one survey-based and one theory-based reflection. In the two following sections we lay out our notions, observations, and theories.

Reflection: ET Design Group

We asked each member of the group to address four different questions. Our answers show a range of familiarity with research, inquiry, and application development. What follows is a summary of question-prompted reflections about our experiences in the group.

QUESTION 1: WHY DID YOU JOIN THE GROUP LANGUAGE, LITERACY, AND TECHNOLOGY RESEARCH AND DESIGN GROUP? WHAT IF ANYTHING DO/DID YOU GET OUT THE GROUP?

Expectedly, having a chance to explore issues of literacy, language learning, and technology was something that drew many members to the group –as was the chance to collaborate on an educational software development project. Others pointed to the chance to refine and develop soft skills such as collaborative and communicative work skills. Academic and emotional support was identified as a latent benefit of group membership as member coursework and experiences overlapped, affording a highly supportive space and a very empathetic audience for concerns. The open nature of the group allowed opportunities for members to give valuable input with little fear of being rejected or overshadowed. Group members entering or contemplating entry into graduate programs in educational technology were exposed to the process of IT research as well as current trends and innovations in the field. Each member was led in unique ways to the intersections of theory, design, and research in an academic context replete with the challenges associated with designing, developing, and implementing educational technology in a classroom with the goal of chronicling, reflecting, theorizing, and explicating that process to the Educational Technology field and beyond.

QUESTION 2: HOW DO YOU LIKE THE WORKING STYLE AND ATMOSPHERE OF THE LLTRDG?

The group functions with the understanding that most members must struggle to fit even a two hour meeting into their busy week so work outside this meeting period is celebrated but optional. This approach was both cause for concern for some members as well as a source of appreciation in others. In essence, we believe our democratic and open management and supportive collaboration style fosters individual and group growth in terms of goal acquisition as well as enabling a sound decision making process.

QUESTION 3: WHAT BENEFITS DO YOU SEE IN PARTICIPATING IN THE LLTRDG?

The group members pointed to improved critical thinking and technical skills as well as a sense of community and belonging within a large IT university department. Exposure to the processes, habits of mind, and tools of development and research in educational technology were the most commonly given beneficial factors among members –affording insight into how one might not only consume but also produce scholarship in the field. From IRB completion to wireframes, literature reviews to collaborative writing, conference proposal submissions to exposure to Subversion, WordNet, Google Groups, and CherryPy members experienced a cross-pollinating effect with each contributing to and learning from the group's collective knowledge base. Through this experience we have supported each other becoming not only colleagues but friends as well.

QUESTION 4: WHAT DO YOU THINK OF THE COLLABORATION AND COMMUNICATION BETWEEN RESEARCH AND DEVELOPMENT GROUPS?

Period four of our group's existence brought with it a number of new members as well as a need to hold separate weekly meetings, one for planning site visits, collecting data, and analyzing it and another meeting for application planning and development. While this increased the efficiency of our group efforts on both the research and development fronts, we wondered if it would change the group dynamic in deleterious ways.

Group member responses to this question indicated that there was minimal collaboration once the groups split; however, this did not prove detrimental in that much of the application design planning had already been completed. As mentioned above, communication between groups took two forms; a single listserv serviced both the research and development endeavors. Also, a few members attended both group meetings and were able to relay messages and preferences between them.

Reflection: Toward a Theory of Congruence in ET Design

Through our experiences and via reading the ET design literature we have come to appreciate just how challenging and complex designing and developing FunWritr has been. The design of educational experiences is influenced by metanarratives about education, by learned beliefs, guiding intuitions, and pragmatic constraints. Yet upon reflection we were surprised at how often a great number of inter-related education and technology-related elements aren't explicitly considered (Yanchar & Gabbitas, 2010). Our affinity-based research and design group has worked to think about how to integrate six interrelated factors in the design process. A review of the literature brought us to Garrett (2009) who outlines four factors to consider when designing language acquisition applications, namely: learning theory, educational context, pedagogy, and technology. To this list we added curriculum and development and with reflection and a review of design documents and meeting notes worked to understand and articulate our positions on these factors –positions which emerged over time and continue to evolve and coalesce. We have found that working toward inter-factor congruence had direct and latent benefits for our design process (Der-Thanq, Hung, & Yu-Mei Wang, 2007). What follows are brief summaries of our positions on each of these factors.

Curriculum

While ET design often springs out of a culture of goals, objectives, and assessments (Demski, 2011; Staples, Pugach, & Himes, 2005), we desired to design a literacy development and language exploration application based on the curricular construct of study as a mode of inquiry (McClintock, 1971). This led us to support language growth and metalinguistic understanding via self-directed, open-ended (Roy, 2003), scaffolded exploration and wayfaring (Ingold, 2007), guided by a focus on intellectual qualities and reflection on what knowledge and experiences are most valuable (Pinar, 2012) instead of which skills and what information students should know.

Theory

As a theory of learning, constructivism resonates with our perspectives on the educational endeavor as an unpredictable process of contemplative experiential knowledge construction (Papert, 1980). Through interest and curiosity, people construct meaning via a process of connection-making between beliefs, remembered experiences, and contextual interactions (Jonassen, 1991). We see literacy development and language acquisition as uniquely experienced (Smith, 2004; Stahl & Hayes, 1997), affective, social process (Au, 1998; Smith, 1994). We draw on theories of implicit literacy and language acquisition that forefront comprehensibility, interest, and engagement (Cassidy, Valadez, & Garrett, 2010; Krashen, 2003) while still respecting the role noticing plays in deepening metalinguistic knowledge (Truscott, 1998).

Context

Employing an ethnographic approach to understanding the educational context into which our designed application would be introduced resonated with our perspectives on knowledge (Noblit, Flores, & Murillo, 2004; Guba & Lincoln, 1998). Ethnography (Wolcott, 2008) allowed us to conduct wide-angle, open-ended, design-guiding inquiry (Barab, Thomas, Dodge, Squire, & Newell, 2004). Our subsequent ethnographic analysis found that most of the space for literacy and language education was dominated by teacher-led activities, however we did identify a few low-key, student-directed moments. The student-directed moments happened predominantly during computer center time, silent sustained reading (Krashen, 2006), and ESL writer's workshop periods (Calkins, 1986). These instructionally relaxed, low-stakes moments were congruent with our other design parameters (Der-Thanq et al., 2007), influenced our pedagogical decisions, and became the target context for which we designed.

Pedagogy

Aligning for congruence with curriculum and learning theory, we drew on pedagogies highlighting open-endedness and exploration (Dickey, 2010; Hannafin, Land, & Oliver, 1999), pedagogies of wonder with multiple trajectories toward understanding (Duckworth, 2006), multimodal approaches utilizing non-textual communicative channels as a way of eclipsing and critiquing the meaning of written text (Derrida, 1997; Kress, 2010), pedagogies that encouraged expression manipulation at different grain sizes (Jewitt, 2006), and used student writing/expression as a primary catalyst for interaction (Roy, 2003). We were guided toward interactions that juxtaposed local meanings and global representations (Schleppegrell & Colombi, 2002), toward approaches that nurtured metalinguistic noticing (Truscott, 1998) whilst supporting curiosity and authorial orientations toward text and language (Smith, 1994). Lastly, we used scaffolds that leveraged and engendered comprehension (Durkin, 2003)

while inspiring appreciation for the inherent messiness of language (Coles & Hall, 2001).

Technology

From the beginning, it has been our belief that as a field, ET does not need iRobot or HAL 9000 to support literacy development and language acquisition. Instead, ET can serve learners well in terms of supporting or scaffolding student-driven inquiry within open-ended environments via educational redesigns of the technologies at hand, namely API-accessible content repositories and knowledge bases, natural language processing tools (Bird, Klein, & Loper, 2009), and invisible mashups designed specifically for educational purposes(Liu, Horton, Olmanson, & Wang, 2008).

Development Process

We added the development process to our collection of ET design factors, while not commonly considered a design parameter by itself, the approach to and process of development influences the points at which and the extent to which design trajectories may be altered. An extreme or agile programming orientation (Stober & Hansmann, 2009) allowed us to collectively continue to modify and calibrate the design based on refinement in our positions on the other design parameters, things we were seeing in our ethnographic research, as well as recent developments in emerging technologies. Instead of designing wireframes of all of the functionality up front, we were able to influence the nature and direction of development through our bi-weekly development sprints or planning sessions. As mentioned above, this allowed us to take advantage of insights we gained throughout our period of participant observation in a local elementary school classroom, while also ensuring that student-members of the group joining the group after development had begun were able to contribute their ideas via our iterative development cycles.

A Brief Description of FunWritr

This section gives a brief overview of the designed ET application. Figure 1 below gives a snapshot of the application's architecture. FunWritr's user interface is Flash-based with a Python/CherryPy backend pulling from a MySQL database. The interface design of Funwritr was influenced by the fact that our users are elementary school children. Working with a teacher at a local school, and observing her students using other writing software as well as performing a range of literacy tasks we worked to create an iteratively designed web-based application that uses the semantic relationships between lexical items in a freeform "playground" environment. Depth and light were used to establish a sense of open-ended space within the established boundaries of the browser window. Variations on muted primary colors connect various functions visually; blue is used mainly to connect text and image results, yellow for word disambiguation.

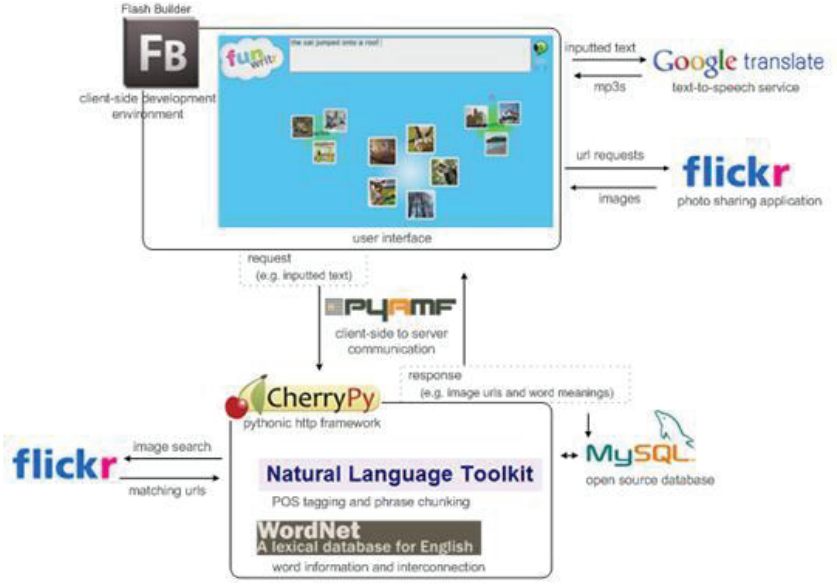

Figure 1. Overview of FunWritr Architecture

Vis the use of existing natural language processing tools such as grammar parsers (NLTK), semantic ontology databases (WordNet), and image collections (Flickr), FunWritr gives users the chance to see visual representations of the words and phrases they write. As learners produce text it is parsed and semantically-organized, modally-rich content is returned. FunWritr is image-centric, and organized around metalinguistic aspects of language.

The client-side of the application required a design that was stable, flexible, and fast enough for our users purposes and patience. To realize this, each component of the project was modularized and connected to a central control method that serves as the backbone and guide of the client-side of the application. The main components include the input box, image bubbles, and server communication. All three modules communicate exclusively with the control module, which allows for easier programming and debugging while providing a more deterministic, stable control flow.

The input box has several functionalities. Firstly and most crucially, it needed alerts the module of spacebar events which are used as a trigger to send newly written text to the server-side part of the application via PyAmf for processing. Secondly, the largest chunk of recognized grammar closest to the cursor is highlighted and corresponds to the displayed images. Finally, the composition area also displays the parts of speech associated with each word and each highlighted phrase.

Image bubbles contain graphic representations of highlighted words and phrases. These images are dynamically loaded from Flickr and displayed in a semi-randomized way. A separate container class manages these bubbles, positioning, adding, and removing them as required based on user actions. Styles for all graphical components are managed in a separate module to ensure a clean seperation of code, design, and content.

The Flash/browser application is connected to a python backend that takes care of the parsing and analyzing of texts. We established a protocol between the client-side

and the python backend that allowed for a robust flow of information between the processes while minimizing performance hits. Some tasks, such as word disambiguation necessitate a substantial performance cost. Therefore we try and do these as infrequently as possible. Word and phrase information is cached within the Flash application and stored in the server-side database to improve response time. Additionally, session and transaction information get logged as a way to recreate, organize, and coordinate messages between Flash, the python backend, and the database.

As stated in an earlier section, the application is designed to use student writing as a catalyst for interaction and feedback. As the user enters text, a collage of images is returned to reflect the meaning of the phrase closest to the cursor (see Figure 2). Additionally, nouns, verbs, adjectives, and adverbs within the highlighted phrase are displayed in its own three-image collage around the periphery of the center phrase collage.

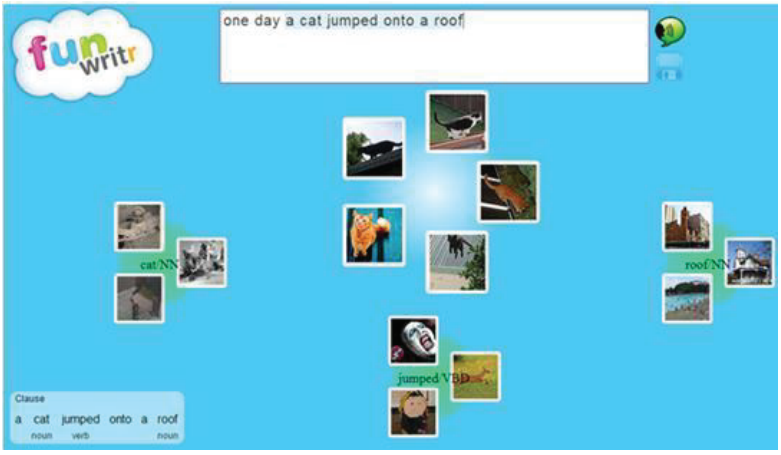

Figure 2. FunWritr Composition Space

In Figure 2 above, each three-image word-based collage in the composition space (cat, jumped, roof) is clickable, activating a word meaning and disambiguation carousel/environment that displays images, definitions, and similar words for each distinct meaning of the word. In Figure 3 below, each meaning of the noun 'cat' is displayed in it's own panel. We designed FunWritr to employ several strategies to ensure the images returned are appropriate for the classroom environment. While using a dynamic, open-ended dataset like Flickr creates the possibility that potentially inappropriate content could be displayed in the course of an interaction we employ several strategies to mitigate these risks. Firstly, we filter, flag, and replace the 1250 words most likely to return potentially inappropriate content –swapping in relatively equivalent inoffensive words in their stead. Also, our image sorting algorithm strives for relevance over interestingness which we feel further reduces the potential for objectionable content. Finally we request images that fall in the category of 'safe content only' as defined by the Flickr community.

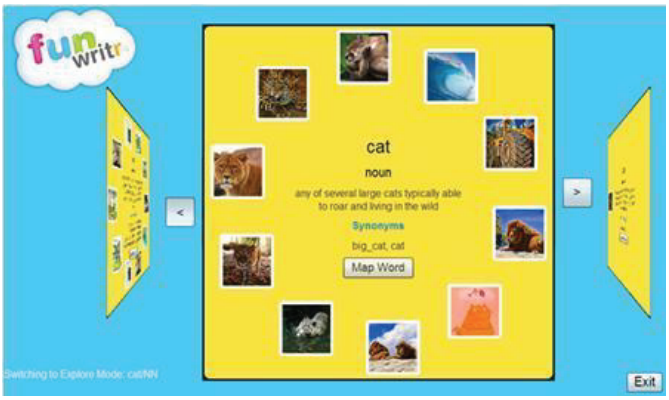

Figure 3. Clicking 'cat' in Figure 2 yields a word meaning disambiguation carousel

Specific meanings or senses of a word in Figure 3 are explorable via the ontological connections between particular meanings of a word and other words within the same semantic family. For example, Figure 4 shows a student who has navigated from 'cat' to the more specific-yet-related 'big cat,' showing the parent (feline) and child (lion, jaguar, etc.) connections in a clickable multimodal environment.

Figure 4. Clicking 'Map Word' in Figure 3 yields an interactive ontological map

Initial Use and Functionality

This section gives a brief recounting of FunWritr's current status and trajectory. We are currently refactoring the server-side code so that we can begin introducing a beta version of the application into several different learning spaces. In testing our current version with a number of elementary school students we came to the conclusion that in order to use it with entire classes of students we needed to improve its performance and stability (as it crashed with regularity and slowed noticeably when more than one person used it simultaneously. In our work with students we found that their patterns of use varied greatly. Some used it primarily as a composition space while others

preferred to become language tourists, exploring ontologies. Still others used it to generate pictures they wanted to see.

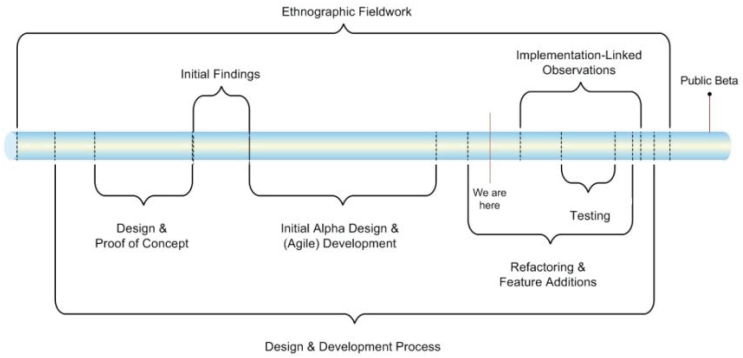

Figure 5. Timeline of the project from inception, to present, and beyond

Conclusion

Based on our experiences in working together to design the ET application FunWritr, to write conference papers, make presentations, and an analysis of member-generated reflections, we feel that unfunded, student-initiated research and development affinity groups hold encouraging potential to serve the ET field as an untapped and innovative approach to research and design education. Over the past four years we have explored and experimented with new ideas pertinent to our field and potentially beneficial to young learners. Through the interwoven individualistic and group learning process of design and production, we produced relevant research while developing transferable and sought after ET competencies and skills. In retrospect, our group offered and continues to offer the possibility of experimenting ideas via trial and error in a supportive ET design context where failure is as much an opportunity for learning and growth as success is. We have opportunities to cultivate qualities of leadership, collaboration, and communication. Qualities that are indispensable to the field of ET research and design.

Furthermore, in thinking about and employing a number of inter-related ET design elements, we have been able to sidestep the critique that advances in technology drive ET development to the detriment of pedagogy (Heift & Schulze, 2007). Instead of pitting pedagogy against technology, we have shown how multiple factors can implicitly and/or explicitly, powerfully influence the creation of ET applications (Garrett, 2009). By taking an explicit, deliberate orientation to inter-factor resonance (Der-Thanq et al., 2007), we feel we have designed an epistemologically, theoretically, and pedagogically congruent application as well as ET design process that incorporates sound curricular, learning theory, pedagogy, contextual understandings, recent socio-technological developments, and the best development methodology available given our affinity-based ET design orientation.

Implications

The iterative, collaborative, shifting act of designing educational technologies for real-world contexts puts designers and developers in the heady and humbling position of creator. The instructional systems, digital worlds, and microworlds (Papert, 1980) that emerge from their efforts require a great deal of time and effort to create. By working together in affinity-based ET design groups, students of ET design can contribute to the field, build community, grow as ET designers and researchers, and add marketable skills while still in school. With minimal levels of mentoring and institutional support other groups like ours can be created and supported.

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