Domains of Expertise Developed in a Project-Based Game Design Workshop
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Objectives and purposes
With the growth of interactive game-making and modding tools, independent designers are actively creating and distributing interactive web games online, and developing games in workshop settings and communities of practice. One example is the Globaloria program of the World Wide Workshop Foundation. This presentation explicates the domains of expertise developed by Globaloria student participants.

Theoretical framework
In Globaloria, WV middle school, high school, and community college student participants use learning supports including a networked course wiki, online syllabus, embedded video- and text-based Flash Actionscript tutorials, virtual and in-person educator and student training on game design, and a virtual help desk in which students can reach out to professional game design experts for live, real-time support. The project currently reaches 40+ groups and over 800 students throughout this state.
Seely Brown (2005) notes that "since nearly all of the significant problems of tomorrow are likely to be systemic problems ... our students will need to feel comfortable working in cross-disciplinary teams that encompass multiple ways of knowing" (p. 2). As such, he emphasizes the importance of "learning to be" and role-taking experiences for learners. Seely Brown's discussion of role-taking echoes Shaffer (2006) who uses the term "epistemic learning" to describe largely the same process.
The Globaloria founders applied Constructionism, situated learning, social learning systems, and computational thinking principles to the program's design and development (Harel & Papert, 1991; Seely Brown, 2005, 2006; Lave & Wenger, 1991; Guzdial & Soloway 2003; Rich, Perry, & Guzdial 2004; Reynolds & Harel, 2009). The learning objectives of the project (Table 1) specify that students will develop expertise in these practices which will contribute to more active participation in today's digital culture and knowledge-based economy (Reynolds & Harel, 2009).

1. Invention of an original digital project concept (in this case, a game), and, successful development and completion of a finished computational artifact representing the concept.
2. Project-based learning and project management in wiki-based, networked environment
3. Posting, publishing and distributing digital media
4. Social-based learning, participation, and exchange
5. Information-based learning, research, purposeful search, and exploration
6. Surfing websites and web applications

Table 1. Learning objectives of Globaloria, the 6 Contemporary Learning Abilities

The study we refer to here posed two broad research questions at the outset:

- In what ways are high school student participants in the Globaloria program learning game design, in the context of the co-learning model?

- To what extent did high school students develop new skills and learning abilities through their participation in Globaloria in Pilot Year 3 (2009/2010)?

These questions were addressed in a qualitative case study of two high school students, using data sources including wiki activity, student project artifacts, videotaped presentations, and qualitative responses to the pre-, mid-, and post-program surveys (Reynolds, 2010, http://www.worldwideworkshop.org/pdfs/Globaloria_WV_RTC_Student_Case_Study_2009-10.pdf).

One case study student, Vanessa, was 17 years old and a senior in high school. The other student, Craig was a 15-year-old sophomore. The students participated in Globaloria daily for 80 minutes. Mrs. A was the teacher and was in her third year as a Globaloria educator. A few of the findings are briefly summarized here, and given the scope of this conference session on expertise, are framed in the context of some issues related to formative assessment that need to be addressed in ongoing research in Constructionist, project-based workshop learning as implemented in formal school settings.

Findings

In exploring the online artifacts available for two students, Vanessa and Craig, we see two quite different types of learning occurring. Vanessa is a high-achieving year-long participant, and senior in high school with significant prior technology experience and an interest in a career in game design, who focuses her work on computer programming and leverages the opportunities afforded in Globaloria to advance her expertise as she transitions to college, winning a prize Globaloria's annual STEM game design competition. However, she is quite narrow in her focus throughout the year, on the mechanics of game design, largely omitting engagement in several other activities the program affords, including the use of the wiki and social media such as blogging, and building out and developing the subject and message of her game. These activities give students practice in the fuller range of 6-CLAs, the learning objectives of the program.

In contrast, Craig is a younger sophomore HS student with very little prior experience in technology use, who has never seen a blog at the start of the class. Through his participation in an inconsistent program implementation by the educator in the first semester (in which the overall class's game topic focus was changed midstream in October from open-choice to Civics), he experiences several ups and downs. However, once situated in a game design context motivated by the game design competition, and partnered with a student who he sees as "a whiz," he experiences a shift in attitude and becomes an enthusiastic online researcher of the political parties, and begins to blog more frequently. It seems he enjoys using social media tools best, and his educator indicates that he completed all of the artwork and a small amount of the coding for parts of his final game. It is unclear from the final game what specific programming skills he himself gained however in comparison with his teammate; this was difficult to confirm using the

extant wiki data since the team page and final game file represents collective team work on project artifacts.

While Vanessa received an A in the class, apparently due to her programming skills, Craig received a C. Overall, it appeared from our observation that Craig engaged in a broader range of practices in alignment with the 6-CLAs, but he did not achieve the deeper programming expertise attained by senior student Vanessa, who skipped many of the CLA practices to focus on activities central to CLAs 1 and 2.

We do not have data indicating the educator's grading scale used, and were not present in class to observe student engagement, thus are largely unaware of the justification for the grades. However, if engagement in and achievement of expertise in the full range of 6-CLA categories is the stated learning objective, and all CLAs are held equal, then based on our case study findings and evaluation of student work on the wiki, it appears perhaps the grading for Craig might have been somewhat misaligned.

Overall, educator assessment of project-based learning in Constructionist, workshop-based contexts is the topic of concern. In our research, we have observed that novice educators in the co-learning model tend to be very liberal with A and B grades, possibly because they are not confident yet themselves in the course objectives and their own capacity to support students given their own early novice technology expertise, and thus feel it is unfair to grade lower; or, they do not yet have a finely tuned evaluative perspective, to distinguish differences in student performance and outcomes yet. In this context, teachers are co-learners with students. How do we accurately and fairly evaluate students in this context? To what extent is teacher grading and evaluation linked to their own performance and accountability? To what extent do student failures indicate a lack of adequate educator preparation or a need for greater teacher professional development support, when dealing with this new domain of learning and expertise in the school setting? In what ways is the grading in this new program Globaloria still subjective? How can we scale the assessment so it is made more fair and uniform?

Globaloria is a social learning system in which students and educators share a semester or year-long Constructionist game design experience involving engagement, realistic imaginative activity, and alignment – all hallmarks of a social learning system (Wenger, 2003). The program is still in pilot, and is offered as an elective, but student grades are listed on their transcript. Educators are provided optional rubrics for assessing and evaluating student project-based work. These rubrics were simplified and adapted from a content analysis coding scheme that was generated for research purposes by the author.

However, it is still unclear the extent to which these tools are used, and to what effect. A greater program emphasis on establishing learning objectives (and perhaps establishing *varying learning objectives* for different contexts, given a location's customized focus) might be called for. Further, there is a need for establishing appropriate evaluation mechanisms that results in greater fairness and uniformity, and, addressing expertise in the context of groups.

This case study also exemplifies some of the questions and dilemmas our field may face as we approach a potential transformation of school cultures, for instance toward the goals of the National Education Technology Plan. Game design-focused educational technology programs have been linked to computational thinking, learning of core curricular domain knowledge in the area of the game's topic (e.g., fraction games), systems-based thinking, and introductory computer science skills as outcomes. Developing valid and reliable methods for assessing and evaluating student project-based work in such new areas will become more necessary, now that they are cropping up in schools more frequently. Such work must address the fact that many teachers are not yet experts themselves in such domains, and are engaged in their own learning curve as co-learners.

A third important strand of this research must address the validity of evaluating the work of the individual in the context of the team in design-oriented project-based work, given that students learn game design through group work in this workshop-based model. The field of computer-supported collaborative learning has much to offer here. In Globaloria, students often appropriate different roles in the team and shift/trade these roles across time, based on individual interests and team dynamics. Assessing and evaluating such epistemic learning (i.e., learning that involves professional role-taking, per Shaffer) that also occurs collaboratively and results in collective team artifacts is somewhat challenging; methods are needed for such evaluation. In this context, variation in learning styles can be accommodated with differentiated support, and differentiated outcomes may result, given variation in role-taking tasks and sequences. Such variation must be considered acceptable. Thus, "uniformity" and "consistency" of evaluation is perhaps not even achievable or desireable.

If schools evolve towards social learning system and community of practice models leveraging technology and project-based work, assessment and evaluation systems and models must evolve with it. If this is to be, then formative assessment is likely a growth area for our field. Researchers of the Globaloria project are reviewing these literatures and planning continued development and refinement of formative evaluation and assessment supports for our current educators in the game design pilot, that allow them to more keenly observe and measure student engagement and learning through evidence-based practice. As we investigate these matters, we are also observing and taking note of the relationship between educators' pedagogical practice and the accuracy and consistency of evaluation in students' development of 6-CLAs, and their own learning curve of expertise in the 6-CLA practices, themselves. As a model pilot program, such investigation is important for the ongoing development of this social learning system and support of students and teachers, and, for greater innovation in the area of assessment and evaluation of student learning and educator professional development, that is needed in such new systems cropping up in today's pioneering schools.

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