Learners as Informants of Educational Game Design

Beaumie Kim, Lynde Tan, Mi Song Kim
National Institute of Education, Nanyang Technological University
1 Nanyang Walk, Singapore 637616
beaumie@gmail.com, lynde.tan@nie.edu.sg, misong.kim@gmail.com

Abstract: This paper describes an educational game design approach that attempts to position learners as the best resources in knowing what engages them in a learning environment. This approach, known as informant design approach, enables young people to draw on their cultural experiences in learning and gaming as resources for game development. In the three-year research and development project, we conducted five progressive informant design workshops with twenty adolescent learners, where their conceptions of earth science as well as ideas for game design are considered at its various stages of educational game development. Our findings from the qualitative analysis of video and artifacts draw attention to the learners' cultural models of learning and gaming and discuss the importance of engaging learners as informants of educational game design.

Introduction

Young people may often be thought to be ignorant of what is best for them. This paper attempts to position learners as the best resources in knowing what engages them in a learning environment, for educational game design. Such a disposition to game development is inspired by Gee's (2003) argument about cultural models and the role they play in learning. According to Gee (2003), cultural models are:

> stories or images of experience that people can tell themselves or simulate in their minds, stories and images that represent what they take to be "normal" or "typical" cases or situations … We act with others and attempt to make sense of what they are doing and saying. We interact with the media of our society and attempt to make sense of what is said and done there, as well. (p. 146)

Bartlett and Holland (2002) would concur that learners bring their cultural models to learning environments. Using the term "cultural worlds", Bartlett and Holland argue, "cultural worlds are continuously figured in practice through the use of cultural artefacts or objects inscribed by the collective attribution of meaning" (p.12). It was our aim to involve learners in our game design by providing them with opportunities to reflect on their cultural model of the way they think about learning and gaming and use their "funds of knowledge" (González, Moll, & Amanti, 2005) as resources for the design.

In this paper, we describe how the design approach, known as the informant design approach, has helped us understand young people's cultural models of learning with games. In this approach, we were able to create commonalities of experiences among the learners so as to help them reflect upon their cultural models of learning and game play. We were also able to explore ways to better encourage learners to use their own funds of knowledge for learning and designing by crossing the boundaries between their formal classroom learning and their cultural practices. The findings highlight the use of their cultural models as resources for the design as well as their cultural models being challenged by the constraints of designing an "educational" game, which they also felt should be different from commercial games they were familiar with.

Methodology: Informant Design Approach

With the emergence of new technologies, how you learn in and out of the classroom is drastically changing. At the same time, today's youths are not only the users of emerging technologies but also creators of many contents occupying them. In recent years, the idea of involving the target users of educational resources or tools during the development stages has been cited as a more efficient approach in meeting the pedagogical needs of those who may use the resources or tools. Many studies have reported the merits of such an approach, namely to allow the users' contributions to be effected into the redesign processes (Scaife & Rogers, 1999) to gain access to the first-hand knowledge of the users' needs and preferences (Antle, 2003; Scaife & Rogers, 1999); to tap on the creativity of the users (Antle, 2003; Rudd, Colligan, & Naik, 2006; Scaife & Rogers, 1999); and to help very young children to express their ideas (Walsh et al., 2010). Of note is Facer and Williamson's (2004) argument that when co-designing educational technologies with their target users, the following benefits of such an approach are evident: "(i) it offers first hand experience of the needs, interests and requirements of end-users; (ii) it enables developers to be surprised by users and to avoid creating formulaic work; (iii) it allows developers to avoid costly mistakes and identify design difficulties at an early stage; and (iv) it offers the opportunity to create resources that are embedded in teaching strategies and educational contexts, and which consequently, actually achieve their educational aims" (p. 1).

Depending on the roles of the young people, the processes are called user-centered design, participatory design, and informant design approaches (Facer & Williamson, 2004). User-centered design views young

people as testers for designs to assess whether their needs are met (Norman & Draper, 1986). However, the limited involvement often does not allow timely input into the redesign process (Scaife & Rogers, 1999). Participatory design considers young people as partners throughout the design process by assigning them more equal and responsible roles and empowering them to make design decisions (Druin, 1999). The true "partnership", however, is unlikely: young people do not see adults as equal in making design decisions; and adults do not see that young people can control the design directions (Scaife & Rogers, 1999).

Informant design approach (Scaife & Rogers, 1999) takes a moderate stance in terms of the young people's role in the design: they play various roles in each stage, depending on when researchers believe they can give appropriate information and ideas. Facer and Williamson (2004) highlighted that in informant design approach "children or teachers are seen as experts or 'native informants' informing designers of key issues related to their experience, helping to develop early design ideas and testing prototypes in development" (p. 1). In our study, we have found three compelling reasons for using informant design approach to develop a game for learning earth science concepts (Kim, Tan, & Kim, 2010): "(i) it creates an intertextual link with other sources of the students' knowledge; (ii) it creates deeper meaning making for the learning of earth science concepts; and (iii) it taps on their funds of knowledge, bridging their school and out-of-school practices" (p. 2).

In our designs, we have adopted a similar stance as Facer and Williamson (2004). A key goal of our project is to develop a 3D multi-user game to recreate and replay parts of Earth's history to use within the school Geography curriculum to address contents related to the Earth's processes. We call this game "Voyage to the Age of Dinosaurs" or VAD for short. This is because the theme of dinosaurs is found appropriate for approaching the topics of the Earth's processes focusing on fossilization, which has the potential to provide learners with alternative ways of experiencing Earth processes as part of a complex whole and to support understandings of the relationships among geological events. Therefore, dinosaurs as extinct creatures and their fossils as traces of Earth's history were considered as the conceptual and motivational anchors of VAD. Figure 1 shows the scenes in one of the VAD prototypes where players interact with dinosaurs in the past world (early Cretaceous) where there exists both abundance and danger (i.e., fertile lake with volcano and volcanic eruptions). These dinosaurs are the same kinds as the fossils they search in the present world in the VAD game.

Figure 1. Navigating using compass bearings & interacting with dinosaurs in the past world

Over the course of three years, we conducted five progressive design workshops as our informant design approach. There were twenty-two students between the age of thirteen and fifteen (equivalent to US Grade 7-10) from two secondary schools participated as users and design partners; their experiences with technology center around online communications activities and online games, such as *MapleStory* and *World of Warcraft* based on our initial survey. These workshops helped us establish a framework for collaborative design practices with students (as suggested by Brown, 1992; Druin, 1999; Scaife & Rogers, 1999). We started by the effort of listening to students' voices and continued to encourage their agency in the design activities. Each workshop can be characterized as: (Workshop I) Understanding Learner Conceptions about the Earth; (Workshop II) Creating Learners' Narratives about Earth and Dinosaurs; (Workshop III) Dinosaur Game Play and Ideas (Prototype I Testing); (Workshop IV) Experiencing the Game Narrative (Prototype II Testing); and (Workshop V) Designing Specific Parts of the Game (Prototype III Testing) (refer to Figure 2.).

For this paper, the data is drawn from the student-created artifacts (20 individual and 16 group) and 16 hours of video recordings of their group work. The artifacts and videos were annotated for various activities they were involved and then analyzed for themes. We started with an open, vertical coding for look out for emerging themes for each group by data types (i.e., artifacts and video). We then conducted horizontal coding where we compared the themes across the groups (Lincoln & Guba, 1985). We discuss various themes of students' ideas and cultural models around the issues of learning and gaming. In their discussions during the design workshops, they made use of their prior knowledge from what they had seen in movies and other media, and from their gaming experience. Drawing on Gee's (2003) cultural models, we present the three categorizations of the learners' cultural models of learning in education games: 1) ideas as model answer, 2) gaming as non-learning, and 3) discovery or forced reading.

Their pre-existing cultural models on how learning only took place through overt instruction by the adults (such as teachers and parents) had been continuously surfaced and challenged during the informant

design workshops. In the following, we describe how four groups of teenage students (4 or 5 persons in one group) shared (and transformed) their cultural models about games and learning through these design workshop. We present themes that emerged consistently across all four groups. In the interest of the space, only illustrative examples are presented in our discussion below.

Learners' Cultural Models of Learning in Educational Game

Ideas as the Model Answers

In our efforts to listen to learners' own ideas about educational game design, we were able to understand their cultural models on how they had been gaining knowledge and understanding. Specifically, when we asked the learners for possible game ideas, they regarded the notion of ideas as information they could recall. During Workshop I, learners often looked for "correct" information in their mind from what they remembered from books, media and remarks by authoritative figures such as teachers and parents, and tried to reproduce them. During the discussion on how volcano erupts, one of the groups was engaged in a conversation on whether or not their teachers had taught this topic and how they could not remember even though they thought they had heard something about it before[1]. In developing a story and a short film about dinosaurs and their fossils during Workshop II, some initially looked for good "answers" by suggesting imitating what the research team had provided as an example.

Gaming as Non-Learning

In Workshop III, there were conflicting discourses about how learners could learn in games. When asked to design the "hottest" game in town, they were focused on how they should have challenging tasks to improve their skills and acquire more advanced tools. This means that they want to become a better game player by playing the game. On the other hand, as a suggestion to improve VAD prototype I[2], some proposed having many stages to complete by answering questions correctly, which mirrors knowledge "testing" culture of schools (and/or many "educational" games). While designing games for learning, students were making attempts to bridge their game play (outside school) with school learning (i.e., by suggesting question-and-answer part for the game). For them the intertexuality of "gaming" (i.e., learning skills by playing) suggests a separate regime from that of "learning" (i.e., gaining knowledge to be tested).

During Workshop IV, students played and made suggestions for VAD prototype II. In this prototype, players could earn Experience Points and lose Health and Life points - if players lose life, they were sent to the Health Camp, where they could consult a Dinopedia and complete quizzes on volcanoes and rock types while "recovering," before they returned to active play. Again, some criticisms pointed to the overt nature of the pedagogy in the Healing Camp (i.e., solving quizzes and puzzles to restore their lives).

On the other hand, some suggested using questioning of knowledge in the context of players advancing within the quest or to the next level. One group suggested, *"Assemble the fossils after the excavation. Take them to Dr. KongLong. He will test your knowledge on fossil and dino rocks and dinos. If you gain xx points, you will advance to some time-travelling expedition. But if you don't, you will lose all your points and fossils."* They also wanted the Healing Camp to be a more of training ground where they could practice shooting dinosaurs, which would help them do better in the game. What they had suggested indicated how learning happens incrementally through practice and multiple achievements (Gee, 2003), where learners repeat the same activities (i.e., searching & assembling fossils, being tested by Dr. KongLong, keeping themselves from dying, and shooting dinosaurs) until they are successful so that they earn points, improve skills, and move on to next levels.

Discovery or Forced Reading

Additionally in Workshop IV, students' suggestions were looking for more challenges and discovery, which would allow them to have different achievements depending on how they play in the game. For example, one group suggested a narrative where the "*[t]ime Machine spoil: everyone find materials to build time machine*", whereas another group wanted to discover various things as they go by having "*[h]idden passages, traps, hidden eggs, time-traveling expeditions, weapons to be found on the floor.*" For the things they needed in order to advance and gain points for the game play, they expected themselves to explore the environment and find these resources themselves. On the other hand, students suggested the objects, characters, and the environment to embody information for educational purposes. They said, *"Upon capturing of dino, the info will be in the logbook/displayed on screen for 2-5 min (forced to read)"* and *"Labeling species of dinos"*, which resonate with Gee's (2003) "Material Intelligence" Principle of learning (i.e., knowledge is stored in the environment/objects).

These learners were suggesting that the main thing to learn in the game was the information about various kinds of dinosaurs; such fact finding practice was integral to the gaming experience outside of school. For instance, in many online game forums for monster-appearing games that they had played, one of the main information shared and sought for were the list of different kinds of monsters. Dinosaurs' species are also important information in understanding evolutions of various animal species and highlighted in many existing media (e.g, books, TV shows, movies, games, museum displays). At the same time, this shows their conflicting cultural models about learning in that the "reading" needs to be forced in order for it to happen (and perhaps

they think it is important that they read information provided even though they do not like to do so). In the short excerpt[3] of students' conversation below, it is notable that in the midst of their effort to bringing in educational purpose in the game ideas, they kept drawing on their cultural model of dinosaur as a gigantic and violent creature that is a good fit for their monster image of games:

1. Ken: Perhaps this can also be education. Like, for example, you gather the DNA of different dinosaurs then introduce dinosaurs.
2. Nick: But, then when you get back to the present right, then a GIANT dinosaur follow you, then it is the boss stage[4] (waving hands around to show that it is big).
3. Facilitator: Boss stage some more? Haha (all start laughing)

Although students tend to get more excited about the prospect of fighting bigger and stronger dinosaurs (turn #2), some have started to show some agency in trying to reconcile the perceived divide between gaming and learning, by suggesting how to earn the information (they deemed important) themselves in the game (turn#1).

Implications for Game Design

We learn to think, feel and act in certain ways through our cultural experience in our lifeworlds. These experiences may allow us to form naïve ideas, but at the same time, become generative resources for learning when we take them seriously (i.e., situating the concepts/ideas in ways that consider learners' cultural models) (Kim & Kim, 2010). Students, when we initially asked them to produce their ideas about Earth's dynamics and stories, felt obligated to produce model or correct answers. At the same time, their suggestions for gaming tasks (i.e., more actions and achievements) and learning tasks (i.e., more knowledge-based) were mostly separate within their game ideas. Although they have applied a different mechanism to what they have thought "educational" in the game (e.g., displaying information so that they are forced to read it) might mean, they have started bridging the two (e.g., players need to earn such information by performing tasks) over the course of five workshop participations.

Voices ⟶				Agency
Workshop 1	Workshop 2	Workshop 3	Workshop 4	Workshop 5
Concept	Story	Play	Story	Concept
Understanding learner conceptions	Creating learners' narratives	Playing games and with ideas (Prototype I)	Experiencing game narrative (Prototype II)	Designing game quests (Prototype III)
Focus group discussions: Earth & dinos	Fried trips and movie production	Evaluation & brainstorming of games	Enacted hands-on activities of game scenario	Evaluation and design of game quests

Figure 2. Five informant design workshops

Our informant design approach with five workshops might have gradually changed the role of students. The change is in the design of the workshops, the development phase of the game, students' rapport with each other and the research team, and especially students' attitudes toward their own ideas. Figure 2 epitomizes the five workshops, their designs and activities. We started from understanding their cultural models related to the concepts and stories about the Earth and dinosaurs, and shifted toward asking them to expand the story and concepts in the prototype using their own ideas.

We see that our effort has been also shifting from hearing learners' voices to relying on learners' agency. "Voice" has different connotations for different research context (see, Fielding, 2007), but the research often involves the intention that it matters what young people think. For us, it started with trying to understand their cultural models. We often heard their competing voices in their discourse, with which they mixed ideas from adults with their own interpretations and/or sought for correctness or appropriateness of their ideas in the earlier workshops. The learner agency we saw from the participating students was their use of their cultural models about gaming and learning in their design ideas to merge them together, which is similar to what Greeno and van de Sande (2007) called, conceptual agency: choosing or adapting concepts/strategies/methods for use in problem solving or understanding.

As mentioned earlier, students were also challenged with their cultural model on how they see the game disconnected from the real world, especially from learning. Through the design and development of the

workshop and the game, and the workshop implementation with students, we were able to explore various ways to embody concepts within the game environment as well as to realize how difficult (and/or inappropriate) it is sometimes to do so. Our best interest also gradually shifted from game design itself to focusing on connecting what games can embody with what physical world (including people) embodies. Especially in workshop IV, we translated tasks or concepts we intended in the game into the hands-on activities. Such workshop helped us to see what might actually better represented in the game, what might be better as hands-on activities, and how we might help them link their experiences in and out of the game and in and out of the classroom. Immersion into the game (or other) activities are important, but sitting back, reflecting on it, and linking it to concepts and other experiences are much more important. In conclusion, our design approach, as we were designing workshops and conducting them, taught us how we might better understand and challenge learners' and our cultural models, and how we together develop as better designers and learners.

References

Antle, A. (2003). *Case study: The design of CBC4kids story builder.* Paper presented at the Interaction Design and Children 2003, Preston, England.

Kim, B., Tan, L., & Kim, M. (2010). Unpacking learner voices for educational game design. In *Proceedings of World Conference on Educational Multimedia, Hypermedia and Telecommunications 2010* (pp. 3370-3375). Chesapeake, VA: AACE.

Kim, B., & Kim, M. S. (2010). Distributed emotions in the design of learning technologies. *Educational Technology, 50*(5), 14-19.

Brown, A. (1992). Design experiments: Theoretical and methodological challenges in creating complex interventions in classroom settings. *The Journal of Learning Sciences*, 2(2), 141-178.

Druin, A. (1999). *Cooperative inquiry: Developing new technologies for children with children.* Paper presented at the CHI'99, New York.

Facer, K., & Williamson, B. (2004). *Designing educational technologies with users. Retrieved March 20, 2009, from http://www.futurelab.org.uk/resources/publications-reports-articles/handbooks/Handbook196*

Fielding, M. (2007). Beyond''Voice'': Newroles, relations, and contexts in researching with young people. *Discourse: studiesinthecultural politicsof education, 28*(3), 301-310.

Gee, J. P. (2003). *What video games have to teach us about learning and literacy.* New York: Palgrave Macmillan

González, N., Moll, L., & Amanti, C. (2005). *Funds of knowledge: Theorizing practices in households, communities, and classrooms.* New Jersey: Lawrence Erlbaum Associates.

Greeno, J. G., & van de Sande, C. (2007). Perspectival Understanding of Conceptions and Conceptual Growth in Interaction. *Educational Psychologist, 42*(1), 9 - 23.

Lincoln, Y. & Guba, E. (1985). *Naturalistic Inquiry.* London: Sage.

Norman, D. A., & Draper, S. W. (Eds.). (1986). *User centered system design: New perspectives on human-computer interaction.* Hillsdale, NJ: Lawrence Erlbaum Associates.

Rudd, T., Colligan, F., & Naik, R. (2006). *Learner voice. Retrieved March 20, 2009, from http://www.futurelab.org.uk/resources/publications-reports-articles/handbooks/Handbook132*

Scaife, M., & Rogers, Y. (1999). Kids as informants: Telling us what we didn't know or confirming what we knew already. In A. Druin (Ed.), *The Design of Children's Technology* (pp. 28-50). San Francisco, CA: Morgan Kaufmann.

Walsh, G., Druin, A., Guha, M. L., Foss, E., Golub, E., Hatley, L., Bonsignore, E., & Franckel, S. (2010). Layered elaboration: a new technique for co-design with children. In *Proceedings of ACM CHI2010* (pp. 1237-1240). Atlanta, GA.

Wang, X., Kim, B., & Kim, M. (2011). Extrapolating from students' preconception to "scientific" consensus: Singapore secondary students' conversation on Earth. *The Asia-Pacific Education Researcher, 20*(2), 261-275.

Wikipedia. (2011). Boss (video gaming). *Wikipedia*. Retrieved from http://en.wikipedia.org. Education.

Endnotes

(1) However, some students were able to engage in deeper discourse on how things happen based on their ideas even though some could not let go of discussing their lack of correct knowledge. Details about their discourse are not reported in this paper. See, Wang, Kim, & Kim (2011) for reference.

(2) The first prototype was developed within the storyline of searching the fossils and seeing dinosaurs in action similar to those of students' stories from Workshop II. Players meet Dr. Konglong who asks their help to save Dilong from early Cretaceous period. They first collect fossils to open the portal to the past, where they find information about volcanoes' structure and kinds from the past, and save Dilong and themselves from the volcanic eruption.

(3) We have used pseudonyms to protect confidentiality and removed any parts of Singapore Colloquial English that affected the intelligibility of the language used.

(4) They are referring to a battle or fight with a character, which is generally seen at the climax of a particular section of the game, usually at the end of a stage or level. The boss enemy is generally far stronger than the opponents the player has faced up to that point (Wikipedia, 2011).