Learners' Ideas about Plate Tectonics and Collaborative Game Play

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Abstract: This presentation discusses the students' game quest design during one of our five informant design workshops. We asked our students to come up with ideas about embodying the concept of tectonic plates in the game. We discuss their ideas around three themes (volcanic eruptions as plate tectonics; plate tectonics as power in the game; and collaboration as the game rule).

This presentation discusses learners' ideas on embodying the concept of tectonic plates in a game. We asked them to come up with their ideas during one of the design workshops, which we conducted to incorporate the voices of learners, in developing a game for learning Earth science and geography, named *Voyage to the Age of Dinosaurs* (VAD). We have been working with two Singapore secondary schools in order to develop a culturally appropriate learning design using an informant design process (e.g., Druin, 2002). One of the key intentions of the informant design workshops was to create conditions in which learners' identities would shift from being passive recipients of knowledge, to becoming empowered and acknowledged experts in their own rights. We recognized young peoples' identities as media producers (Pelletier, Burn, & Buckingham, 2010) and gamers (Duncan, 2010) outside of school, who can make references to media texts that are more appealing to them, with their own rich funds of knowledge (González, Moll, & Amanti, 2005). We expected them to foreground their voices by making links between the design tasks and their familiar texts (e.g., classroom learning, media, magazines, textbooks, gaming, family talks), in the similar sense that Lemke (2005) talks about intertextual constellation. The initial stage of the project explored learners' Earth science conceptions and how technology could support alternative ways of perceiving and understanding Earth's processes, using dinosaurs and their fossils as conceptual and motivational anchors for the learning of Earth system science. In this presentation, we discuss our participants' game design activity in one of the workshops, where they negotiated and generated various meanings including tectonic plates and identity in games and the world.

Plate Tectonics and Collaborative Game Play

During the past workshops, students have shared (and transformed) their ideas about games and learning, struggled (together with the research team) with the challenge of combining education with gaming, and positioned themselves as important informants for the development. Students' experiences as gamers, students in school, participants in our workshops, and actors in their lifeworlds all mattered in their idea generations (Duncan, 2010; Pelletier et al., 2010). Students had been working together in their four small groups, and their voices and interactions reflected the group dynamics developed. Their foregrounding of the identities as designers, gamers, and informants who provide important ideas to the research team (as opposed the passive knowledge recipients) became much more apparent. In the following, we will look at the examples from what students generated during the design session, and discuss how students might be making intertextual links.

Volcanic Eruptions as Plate Tectonics

For the ideas about plate tectonics quest, all the groups related it to the volcanic eruptions, which would make changes to the environment and the situation. From their descriptions, we could see how they conceptualized the volcanic eruptions. Two groups (Allosaurus and Barney) were suggesting that a type of man-made moving force (pushing plates by robots or a machine) would somehow make the volcanoes erupt in the game. On the other hand, Stegosaurus and T-Rex were more specific on the internal Earth processes, which were convection currents and pressure. Stegosaurs used plate movements as the context of play and imposing time limit for another quest (dinosaur capture). The drawing and "Warning!" text in
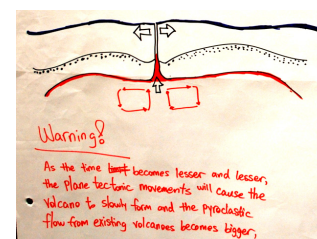

Figure 1. Plates as Context.

Figure 1 accompanied their description of how game players are supposed to bring the dinosaurs back to the future within the time limit. It reads, "*As the time becomes lesser and lesser, the plate tectonic movements will cause the volcano to slowly form and the pyroclastic flow from existing volcanoes becomes bigger.*" In the Figure 1 drawing, they indicated movements within mantle (convection current), of magma (upward to the surface), and of plates (spreading) similar to those of oceanic ridges.

Plate Tectonics as Power in the Game

Students imagined becoming powerful through tools and environment in games, which shows the intertexuality of gaming and technology affecting their design activities. The context of the quest design, plate tectonics, became the source of power in students' designs. All the groups used plate tectonics (i.e., volcanoes) as power-

related mechanism, but the variations were in the role of volcanic eruptions: as player's means of destroying something improper, as something that should not happen (a bad guy trying to make it erupt to kill dinosaurs), or as a context that provides a further challenge to another quest. In Allosaurus' suggestions for this quest, they use a machine, which displays plates on Earth and clues-e.g., volcanoes at point X, Y, Z , and with which players can rearrange using + or – buttons for plates moving toward or away from each other (See Figure 2). Players would need to figure out how to create a mountain, for example, by moving specific plates in particular directions.
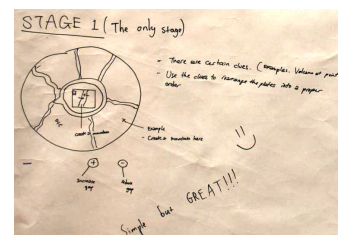

Figure 2. Plate Tectonics Machine

Collaboration as the Game Rule

The students' ideas about the quest probably reflect their cultural models about the distributed nature of the world and games: people achieve things by working with others, tools, and environment (Salomon, 1993). Their game ideas show that they could be stronger and achieve things beyond their capabilities because of other players they collaborate, tools that enable them, and the environmental limitations and/or possibilities, and that these achievements are situated in a meaningful context (for justice, for most of the groups). More importantly, players would be learning/thinking about plate movements together with the tools, the game environment, and/or other avatars. Allosaurus (the machine in Figure 2), T-Rex (the gun, pressuriser 3056), and Barney (the giant and powerful robot to push plates) are all focused on the use of the environment and tools, whereas Barney is the only group focused on working with multiple players. In Barney's scenario, they suggested that multiple players should move plates together and make the volcano erupt in order to wipe out the dinosaurs supposed to be in different period from the current one (early cretaceous). They situated their knowledge about the dinosaur species and their existing eras and their ideas of plates and volcanoes in the situation and the quest objective (i.e., *To exterminate certain species of dinosaurs via volcanic eruption*). The work toward this objective is distributed among the robots (pushing power), the avatars (control of the robots, coordination among multiple robots, control of plate movement directions), the plates (destructive power, cause of volcanic eruption), and the situation (the driving force for the quest). In Barney's scenario (as well as others), the distributed nature of the meaningful situation, the environment, the tool, and other players becomes the important rule of the game.

Conclusion

Students' ideas show that they are indeed experts in what would work for them as a game and how they like to learn. We could interpret above that plate tectonics, for example, should be something they can interact with (i.e., instead of static drawings), and would be most exciting to them to approach through formation and eruption of volcanoes. This workshop shows learners' ideas about different narratives, earth's phenomena, games, and their empowered roles in learning. We must highlight that they probably became more capable of drawing from their own rich funds of knowledge (González et al., 2005) through their workshop experiences. We have argued for designing learning technologies around relational meanings and emotional experiences (Kim & Kim, 2010), and students, if we listen to them carefully, are obviously advocates of our claim. In their quest designs, students positioned plate tectonics (the focus of learning content) as the mechanism for their goal achievement and the motivation for collaborations, and game player as justice-fighter who can use the power of the Earth's processes. Design and learning activities are interrelated, and in the efforts to design with learners, organizing multiple workshops with same group of students seems to be important in order for them to use their workshop experiences as their resources and to help them to become aware of their own ideas and expertise.

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