Distributed Teaching and Learning Systems in *Dota 2*

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Abstract: Teaching and learning are often distributed across many different sites and across time, and teachers and learners can intentionally create and customize trajectories through these encounters. However, we often tend to focus on one site or design for learning. Furthermore, we often fail to recognize the teaching acts used by games and only focus on the rich learning. This paper argues that we can think about "Big 'T' Teaching" (using Gee's "Big 'G' Games as a model) where teaching is a distributed system; this view allows us to trace an "ecology" of teaching and learning systems (borrowing from Jenkins's approach to media). Using the game *Dota 2*, this paper demonstrates one way of thinking about the way teachers and designers can make compelling, distributed systems of teaching that extend through and even beyond the game, and how players and learners can customize their learning experiences.

One theme that has been somewhat underdeveloped in the games and learning literature is the role of teaching in and around games. Many studies tend to focus on the rich learning that happens through gameplay without directly addressing these as teaching interactions as well (Holmes, 2015). Gee's seminal *What Video Games Have to Tell Us About Learning and Literacy* (2003) is a prime example; it outlines a range of good learning principles but never acknowledges that many of these are also good teaching principles. The principles Gee outlines, such as "designing multiple routes to participation" or the "amplification of input," are not just ways in which good learning occurs but also key strategies for good teaching. Squire's excellent *Video Games and Learning: Teaching and Participatory Culture in the Digital Age* (2011) similarly tends to privilege the kinds of learning that happens through gameplay while underselling the specific ways these games function as teachers in their own right. While much maligned, the gamification literature seems to capture something about the ways games teach, although it is often limited to issues of motivation and engagement. Gamification interventions such as Sheldon's *The Multiplayer Classroom* (2012) or Kapp's *The Gamification of Learning and Instruction* (2012) tend to get tangled up in the metaphors of gaming (like levels and points and roles/classes) which can interfere with the truly meaningful insights games provide into teaching (Holmes, 2015). Salen et al. (2008) perhaps addressing most clearly the ways games teach in their Quest to Learn program by leveraging game-like design in their instructional practices, though again the relationship between games and teaching is still left somewhat tacit. I don't doubt that these and other game-based learning theorists recognize that game design features are teaching features, though it is striking how few explicitly address the issue. One main goal of this article is to directly describe the ways a game (in this case, Valve's *Dota 2*) teaches and to point out what that might tell us about teaching more generally.

I also want to extend a pair of related concepts—Gee's (2003) notion of "big 'G' Games" and Jenkins, et al.'s (2006) idea of an ecology of media and communication technologies—to think about both the designed and emergent teaching and learning that happens in and around games. Big G Games, for Gee, include not just the game itself (what happens on the screen) but also a range of other activities and sites like YouTube walkthroughs and tutorials, guides and FAQs, web forums, "theorycrafting," cosplay, machinima, fan fiction and many others. Together, these activities make up the Game, and by considering the many different sites for participation we might gain a better understanding of what playing games really entails. Jenkins's idea of an ecology of media technologies follows a similar epistemological bent, where the relationships between various media forms and participants and the "cultural communities" (2006, p. 8) that form and negotiate practices around them serve as a more informative and meaningful way of thinking about media interactivity. I believe both of these views provide an interesting lens to think about the way teaching happens in games, and especially a game like *Dota 2* where there are many sites where teaching happens.

This article is meant to address these three things: to show, briefly, how *Dota 2* is designed to both teach explicitly and to provide additional "channels" for emergent teaching to occur; to sketch a rough outline of the ecology or relationships between these designed and emergent teaching systems in- and beyond the game; and to suggest some broad implications for teaching that transcends games. I will first look at *what Dota 2* teaches since this deeply influences *how* it teaches. Then I will look at *designed teaching systems* in the game (such as the in-game tutorial and knowledge library), *designed-for-emergent teaching systems* (including the "coach" mode and the streaming/spectator mode), and outside-the-game *emergent teaching systems* (especially Twitch and the theorycrafting site Dotafire.com) in order to show how these teaching systems are distributed across the Game (after Gee's term) and form an ecological network of teaching systems (in Jenkins's terms).

Dota 2 and Teaching

Dota 2, officially known as *Defense of the Ancients 2*, is a Multiplayer Online Battle Arena (MOBA), a sub-genre of Real-Time Strategy (RTS) games, and is published by Valve Corporation (2013). MOBAs, as the name indicates, are online games played in cooperation with and competition against other players. *Dota 2* is played by two teams of five players each who must attack the opposing team's base while defending their own. There are many different strategies possible in each match depending on the composition of each team and their plan of attack ("rushing" the opponent with all 5 heroes, fighting a battle of attrition, playing "hit-and-run," and so on). *Dota 2* also has a very large "professional" competitive scene, which is one of the most important factors in *Dota 2*'s popularity since it is both a participatory and spectator sport.

Dota 2 faces a particularly difficult challenge in that it is a very complex game with over 100 heroes, countless strategies and abilities and so on. The game must teach the player the basic elements (what the goals are, what success and failure look like, the techniques to achieve these). Players must also navigate multiple semiotic domains (the mechanics of the game as well as interface elements) so a player needs to learn how to operate both the operational and conceptual levels of the game. To play successfully, they must also learn somewhat abstract strategies for reacting on-the-fly as the game changes through the course of play. Furthermore, because of the highly social nature of the game, there are complex practices around playing the game that players must learn in order to participate fully in the gameplay experience. These include things like terminology, team composition and strategies, trends in play styles, social conventions and others. Participating in the Game (in Gee's term) requires navigating these social realities as well as the "technical" ones of the "little 'g' game."

To tackle all of these messy teaching realities, Valve has introduced what I believe is a relatively unique set of solutions by designing multiple teaching "channels" or systems. Some of these are designed explicitly as teaching scenarios; the in-game tutorial, for example, is a common feature of most games and *Dota 2's* tutorial is well put together though not highly innovative by itself. The tutorial only covers an almost superficial amount of the actual learning necessary to master the game; it introduces some key features, ones that are absolutely necessary to playing but which hardly account for the deep and sophisticated knowledge it takes to "learn" the game. The tutorial modules are there to *begin* the learning process for the player, and to shape their initial experience and give them a frame for their continued play, but mastery requires tremendous effort by the player. Of course, it's possible to argue that the joy of gaming is in discovering rules and strategies on your own (Koster, 2007), and no tutorial will completely cover every possible concept fully. It is no surprise, perhaps, that the tutorial is only a starting place regardless of the complexity of a game.

The truly clever way that Valve has designed *Dota 2* as a set of teaching systems to overcome the limitations of something like a tutorial is by organizing these other teaching channels to leverage other players as teachers; that is, Valve includes features which are "activated" by other players who perform the role of teacher in cooperation with the game. For example, the game includes a "coach" mode where a player can invite another player into their game and the "coach" can mark up the player's map, control their camera, and has a dedicated chat channel. As I'll describe in more detail below, the game includes a number of these "emergent" teaching systems that are designed by Valve but left to the players themselves to fulfill the role of teaching. And, like many modern games, there also exist a number of emergent teaching sites like YouTube or theorycrafting sites which are outside of Valve's direct designs but which still serve as vital channels for teaching and learning. What is especially illuminating are the relationships (the "ecology" in Jenkins's terms) between these various designed and emergent teaching systems and the way they work together to help teach the complex nature of *Dota 2*.

Designed Teaching and Learning Systems in *Dota 2*

I use the term "designed teaching and learning system" to refer to many of the overt teaching features of the game; these are what might pass as obvious or common sites of teaching across many videogames, including tutorials, didactic showing/telling, descriptive text, and so on. Most games contain variations on these designed systems, although not all games do. These designed systems are insightful for two important reasons: first, they are intended explicitly by the game maker to perform the function of teaching the player how to play (in all the ways "play" might mean); and second, the relative ubiquity of these designed systems across games points to their perceived importance (if not their exact efficacy in every game). *Dota 2* contains several of these designed systems; I will primarily focus on two (the in-game tutorial and the knowledge library) but recognize there are more examples within the game; these two simply provide compelling cases in their own right.

In-Game Tutorial

Dota 2's tutorial is an optional, multi-part tutorial which covers everything from basic camera and character move-

ment to complex, multi-player battles (essentially, the "real" game). The tutorial is completely optional; players can choose to complete it—in its entirety or only portions of it—or not. The tutorial is broken into eight scenarios, each covering a different topic but also organized sequentially so that the scenarios build on top of what previous tutorial sections covered. Players can play any of the tutorial modules only after "unlocking" them by completing the previous module, but they can repeat previous modules as many times as they'd like. The tutorial section also includes two special modules designed as "testing grounds," where players can play a match against the computer to work through the material they just learned in a safe, low-risk environment.

The eight scenarios cover increasingly complex play events. The first scenario is actually non-interactive, instead containing a 4-minute overview of the basic mechanics and goals of the game (the dialogue of which is transcribed above). The second scenario introduces basic movement controls and actions as well as the first instances of melee combat. The third scenario introduces ranged combat and a different hero from the previous scenario. The fourth scenario covers the concept of "lanes" and "towers" (two central features of the map and strategic elements of play). The next two scenarios are skirmishes/practice; one is constrained to just the middle lane, while the other is a "full" match with all three lanes open. The seventh scenario expands on a more specific skill, "last hitting" or killing an enemy to gain gold, as a key feature in high-level play. The final scenario is a practice focused on last hit practice.

It is worth noting that the tutorial section, especially Module 2, is often highly didactic in that the game is focused on core or baseline knowledge and explicit instruction; the game tells the player how to do something specifically and directly and then waits until the player complete that task.

In-Game Knowledge Library

The game also contains a great repository of information—and teaching—outside of the tutorial modules or gameplay called the Library. This is another optional section of the game client where players can look up information about all of the heroes (currently 109 of them) as well as items and more (easily several hundred items).

Within each character "page," there is detailed information similar to that contained in the tooltips but expanded in terms of narrative description. Each character page also contains a description of the hero's various abilities accompanied by a very short video clip of the ability in action. These videos show a specific example (model) of the ability in action, tied closely to some statistical information; it shows what the attack "should" look like in order to let the player know when the ability works and, potentially, how it should be used (in what situation, against what enemies, and so on).

Designed-For-Emergent Teaching and Learning Systems in *Dota 2*

Valve includes another kind of designed system that is, arguably, unique and which makes *Dota 2* such an illuminating case. They have designed a number of systems that are not as explicitly for teaching directly; instead, they are designed to create the *conditions* for teaching to occur but rely on players to actually do the teaching. In other words, *Dota 2* includes several different features which help enable teaching but the game itself doesn't teach; players "enact" the teaching on their own through the designed affordances of these emergent teaching systems. This is a very interesting relationship between designer/game and players in which players are supported (and even expected) to some of the work in teaching, especially of the various social features like terms, strategies, and etiquette but also of more basic gameplay as well. Like designed systems, *Dota 2* includes several different designed-for-emergent systems, of which I will only focus on three. These range across a spectrum of nearly explicit teaching (the "coach" mode) to implied teaching (the community "build" feature) to a highly emergent channel (the streaming/spectator mode).

"Coach" Mode

Players have access to a feature called "coach" mode where another player can help them play the game in real time. Players can invite friends to perform this role of coach, and they use their own game clients to network together to use the feature. Coaches can "take over" parts of the learner's game interface (remotely) and control aspects of it for the player. The coach can, for example, make marks on the players map or action bar that call attention to themselves clearly, a feature not found in the "normal" game interface. This special mode also includes a separate chat channel for the coach and player to use that no other player has access to; it is a tool that they can use to interact "safely" removed from the view of others. Through this coach/player channel, the teacher (coach) can communicate concepts, terms, and the like to the leaner (player), who can use in turn use it to ask questions and so on.

This designed-for-emergent teaching system is meant to give players both access to a more-knowledgeable peer and to provide specific tools for teaching; while there is no prescribed teaching on Valve's part, they have designed tools which support the teaching performed by players. They have also identified or assumed what kinds of tools are important to perform these functions (interface control, marking and highlighting, a "protected" space for learners and teachers to communicate with less fear of calling attention to the learner's status and so on). In essence, they have created special conditions for teaching to occur, though it is up to players to complete the teaching act.

Community Character Builds and Guides

Another way for players to share their knowledge and to teach other players is through the community character builds and guides features. These are interrelated features; the build feature is an interactive tool found in the game client where players can "spec" heroes with different equipment and abilities. They can access these builds within a game and apply it while they play; they can also publish these to the community. The hero builds often (though not always) form part of the guides feature. Guides can be accessed both through the game client as well as Valve's Steam platform. Guides often feature builds that players can import into their game client, though they often also contain a great deal of explanation, commentary, strategies and suggestions, and even debate through a comment system.

Not all players use either feature, of course. Some players may only use the build feature to test out various configurations on their own, and so the game allows them to "teach" themselves by interacting with the tool, although this is not a particularly deep level of learning since the tool is primarily meant to "plug in" to guides or for convenient access during the course of gameplay. The guides provide a sanctioned space to share knowledge and teach other players not unlike a forum but with the additional connectivity of interactive tool tips and the ability to "plug in" to the game client. Once again, Valve has built systems where the conditions for teaching are present and provided additional tools that might be used by players such as the interactive modules and connected platforms or the comment feature on guides but which require players to fill in the content and perform the teaching. Like the coach feature, these are channels where teaching is meant to occur, but they have additional functions that are less-clearly aligned with teaching.

Streaming/Spectator Mode

Many games have vibrant steaming spaces, a feature popularized in part by YouTube and especially Twitch (discussed below). Valve has added an in-game streaming mode which leverages the native interactivity of the client as an additional feature to a "normal" steam site; that is, players use their own game client to watch the games, but have features such as the ability to change their screen to an individual player (including their interface), to a free-roaming camera, and even to a "directed" camera that is controlled by a commentator. Some streams do not include a commentator, but most professional or semi-professional tournament streams do. Stream channels also have a separate chat channel visible only to other streamers and not to the players.

Players enact the teaching in several different ways. In the least direct way, they serve as demonstrations or guides through their play; a player can watch their view and interface and follow along with one particular player (even across many different games) in order to watch an expert play. They witness models (although indirect and often not explicitly intentional) or good players and can learn through watching them make choices, alter strategies and so on. These expert players are teachers in the sense that they model actions, though they may not even be aware that they serve this role; they are, in some sense, "oblivious" teachers and it is up to the player to learn by watching (and, hopefully, have some strategy in their own mind as how to learn through this watching).

Another, somewhat more direct, form of teaching through the stream feature is through commentators. Much like a good sports commentator can break down, explicate, or analyze some part of the game, many *Dota 2* commentators provide a great deal of insight into the thinking of players, description and explanation of the game in action, and "meta" commentary on the game and on *Dota 2* play in general. They almost certainly use much jargon appropriate to the player base and can create or perpetuate these lexical or thematic touchpoints. For example, during competitive matches teams take turn choosing and excluding heroes, and many times commentators will discuss the choice one team made, options for countering it, strategic planning on what teams might do in their next pic or in their overall composition, and even about trends by a team or in the game. Again, these commentators may not directly recognize that they are teachers (though some might), but they do a variety of teaching acts throughout the course of their discussion at several various levels (discursive, mechanical, strategic, meta). Valve has built various tools into the streaming client that must be activated by players.

Emergent Teaching and Learning Systems Around *Dota 2*

It is common that most contemporary games spawn a great deal of Game sites, from lore-based discussion sites to

streams to cosplay and many others. *Dota 2* is no exception, and is indeed not all that remarkable in the sense that the kinds of activities happening in the Game are not terribly different from, say, *World of Warcraft* or *Minecraft* or *Pokémon*. Still, these are extremely important sites of teaching and play a large role in creating, perpetuating, and changing the Game and the game. It is possible (though outside the scope of this article) to consider the various affordances of sites like forums or YouTube, but it is important to at least gesture that various sites are used differently for different purposes and have different affordances and limitations which influence the kinds of teaching and learning that occur through them. There are many, but I will look briefly at Twitch streams and the theorycrafting site Dotafire.com to highlight a few important threads.

Twitch Streams

Twitch is a major site for live game streams, including *Dota 2*. Streams on Twitch are similar to those within the game client expect they are generally locked to one individual player's view or on a commentator's screen (it is not interactive in the way the in-game stream is). Many players also include a small webcam video of their face overlaid on the game screen and use a microphone to talk to their stream audience or to other players. Streamers have a dedicated chat channel to communicate among themselves and often the streamer. Much like the in-game streams, these spaces serve as teaching through modeling, commentary, and player communication. Unlike the in-game streams, Twitch often focuses on the personalities of individual streamers and groups form around popular streamers; here a great deal of social maintenancing happens, and these popular streamers often drive community practices by using particular builds or strategies or other practices (like terms or jokes).

Dotafire.com

Dotafire.com is a forum site where players can post hero builds and discuss strategies (among other things). Like most forums, the site is primarily designed for threaded conversations between many members. Many members engage in a practice known as "theorycrafting" where they formulate often complex models of how various abilities relate and work to maximize performance. These discussion, like many of the hero guides, are often quite didactic (take X ability, perform Y action at a given time) in the sense that these players are explicitly telling others what to do and how. In some ways, theorycrafting is very much akin to traditional in-school teaching; it is interesting that we malign it in an institution but laud it on a videogame website. However, theorycrafting usually requires that the player provides concrete, demonstrable evidence that players can then test out. It is a kind of "prove it" scenario in which other players can validate a theory to make a more reliable or accurate model. In a sense, theorycrafting is a rich scientific practice that relies on evidence and falsification as a core feature. A website like Dotafire.com also has features which enable debate and discussion as a native affordance.

Implications of Distributed Teaching and Learning Systems in *Dota 2*

Let's step back and take a look at these various designed and enacted teaching systems. Within the Game of *Dota 2* it's possible to see many different channels through which teaching happens, from explicitly designed systems to player enacted teaching outside of the game. While this particular analysis is meant to illustrate various sites for teaching, it is also possible to conduct traces of specific teaching and learning across various channels; indeed, this article is meant as an outline to show how it might be possible to conduct such research. Further, *Dota 2* is a complex and dynamic game, and no single event, nor even a set of teaching events can teach all of this complexity. An ecological view of these teaching systems would show that teaching is a deeply interconnected practice, and learning happens at many various sites. In particular, tracing a learner's journey through various teaching and learning sites could uncover important information about the relationships between the various kinds of sites and the kinds of teaching and learning that occur there; it could also demonstrate that it is the act of moving *across* sites that is the valuable part of the learning transaction.

Indeed, what makes *Dota 2* so compelling is that it shows that learners have some control over how they encounter and organize their learning within a Teaching system. It's easy enough to imagine the tutorial as a teaching intervention(s), where a player learns the basics of the game in a series of events designed by Valve. But that same learner may also watch a YouTube "how to play" video instead of playing the tutorial and learn many of these same things (and others not included by Valve). They also might watch some professional competitive matches and learn a great deal about strategies and hero builds. They could follow-up on these strategies by looking at the in-game build guides. They might then try them out in a match, where they get a great deal of feedback about their play with that particular build, and they could iterate in a series of matches to perfect their play or try alternate solutions (possibly after consulting theorycrafting guides or by posting their build and receiving feedback from other players). They might even be inspired by the game to create some artwork around their favorite character, and dive deeper into the in-game library for more background on the story or their character's history. They could take this artwork to a fan site and connect to another fan to write a story or a comic around the game, and share not

just their passion but their knowledge about *Dota 2*. Further research may validate or complicate this learning trajectory, but this is not a terribly unlikely path through teaching around *Dota 2*. It shows that players can customize their experiences across a network of distributed, interrelated teaching sites that the player can configure in a way which matches their interests and their need for more specific knowledge. It also hints at the many different kinds of systems that are configured to teach players as they go. Ultimately, I believe we could can think of teaching as "big 'T' Teaching" in the sense that teaching happens across a range of activities and various times and sites with many different people.

This model also suggests something profound about teaching in general beyond videogames. Elsewhere in this collection I have outlined several game-inspired design principles (Holmes and Ingram-Goble, 2015), and these principles are certainly manifest in the *Dota 2*. From that perspective, the way the game is designed—the way it allows learners to customize their experience or creates a compelling narrative journey for the learner—reflects not just good game design but also good teaching design. A distributed teaching and learning perspective adds another dimension to what a Game like *Dota 2* can tell us about teaching, however. From this perspective, it's possible to think about ways in which teachers can organize networked nodes of teaching, where learners access different teaching acts in different contexts (some didactic, some demonstrative, some hand-on "messing about"). These different nodes can serve different functions towards some Teaching goal. Admittedly, this may not be too far off of what many teachers do; a science classroom often has didactic teaching moments, course readings, lab time and so on, each of which is serving a different function in the Teaching network. While I don't have the room to engage in any lengthy critique of formal or informal education, it's worth considering the claims about the inauthenticity of these kinds of environments (that many of these activities are meant to lead to "real" science but to fulfill some mandated competency) and contrast it with games (generally learning is always aimed at playing the "real" game).

That is not, however, the real power of a distributed teaching and learning model in terms of teaching more generally. This perspective suggests that teachers can design and organize *some* of these nodes (in the same way that Valve can design and organize *some* of the Teaching nodes in *Dota 2*) but not all of them; players/learners have some control and can organize these nodes to fit their needs as described above. For teachers, then, one opportunity is to leverage Teaching systems (which include emergent or non-sanctioned sites) in such a way as to enhance and support the learner's trajectories. In other words, teachers can plan, design, and organize some Teaching events as well as recognize (and hopefully integrate) other sites learner's may utilize in order to create a dynamic and complex system of learning. It is important to reflect here, of course, that this also implies that teachers are not alone in this process but are integral agents networked with other teachers, learners, tools, and pathways. It is a bit of a double edged sword in this regard—if learners can customize their trajectory, especially through sites and teachers outside of the "control" of a teacher—they may learn something completely unintended by the teacher. This can be daunting to a traditional classroom teacher indeed.

Finally, let me linger on that last point. One potential afforded by a distributed teaching and learning system—and one problem for an institution such as school—is that control is also distributed and, in many regards is ultimately left up to the learner. Good designs (such as the kinds of teaching channels found in *Dota* 2) help shape the experience, but players can watch YouTube walkthroughs, talk to other players, and otherwise learn a great deal about the game outside of Valve's control (including things Valve may not want, such as cheats, hacks, or exploits). Distributed teaching and learning systems demonstrate that it is possible to organize all kinds of learning events outside of the control of any institution. This article is meant to emphasize that something like *Dota 2* is tantalizing in the way it might connect learners to many various knowledges, practices, people, and contexts that transcend one teaching and learning site (like school, for instance). It is just as important to think carefully about how those connections are made. On the one hand, we might rethink what a "class" is, how it is arranged, and who participates in the acts of teaching. If we consider that all kinds of people and things can teach, and these various teachers can be arranged and activated in particular configurations to support a broad array of learning needs, we might arrive at very different in-school teaching interventions than what "traditionally" passes for teaching in a classroom. On the other hand, learners who can organize and navigate complex distributed systems outside of the control of an institution like school challenge how we think about the purpose of school in the first place. Instead of a primary site of public learning, it may become just one of many sites where people go to learn, teach, and participate civically. It also changes the relationship between teachers, learners, content, and practice. In short, *Dota 2* just might serve as a model for what 21st century Teaching could look like, in all its complexities.

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