The Time a Tablet Game Walked Into an Early-Learning Curriculum Framework

Jessica Tsang, Dylan Arena, Kidaptive, Inc.
jtsang@kidaptive.com, darena@stanford.edu

Abstract: As a worked example, researchers explicate the process of designing a comprehensive early-learning curriculum framework to support a series of tablet-based interactive animated stories, along with a parental feedback loop.

Introduction

In this worked example we will explicate our process for developing a comprehensive early-learning curriculum framework to undergird a product offering that includes (a) animated stories with embedded games and puzzles to be deployed on tablets (Arena, Gunsagar, & Sharples, 2012) and (b) parental feedback and guidance about how to support learners' progress. This development was in a commercial rather than a research context, so our concerns and priorities may not fully mirror those of our colleagues in academia. Our own academic backgrounds, however, compelled us to hew closely to research-based early-learning literature as we developed our curriculum. Furthermore, our goal of producing something that is both authoritative and easily understandable to a lay audience is one that many academics who want to broaden the impact of their work may share. And finally, one of the primary aims of the worked/working examples movement is to promote communication and understanding across disciplinary boundaries (Gee, 2010): The boundary between industry and academia is surely a fitting one to try to cross.

We will examine three main aspects of our development process in this paper. First, we will describe how we "sourced" our curriculum (i.e., what resources and expertise we relied upon to establish a *comprehensive* and *authoritative* curriculum) and present briefly the results of this effort. Next, we will explain why having a *comprehensive* and *authoritative* curriculum was a design goal in the first place. And third, we will discuss the ecosystem we hope to create around this curriculum.

Our Sources and Sages, and the Resulting Curriculum

The authors of this paper are learning scientists, but neither of us focuses specifically on early learning. (Simply having young children, it turns out, does not make one an expert: One's own children only inconsistently behave in generalizable ways.) So our first step was to cultivate a relationship with a master preschool teacher and lecturer on early child development at our local university. In the spirit of reflection that the worked-example movement is meant to embrace, we should note that this simple act of social connection may have been our single most fruitful research step. Our master teacher helped us capture every set of research findings, standards, guidelines, and best practices for early learning that might possibly be relevant while also steering our attention away from lower-quality materials. (Too much data, as researchers in this information age know all too well, can be its own curse.)

We synthesized this diverse literature, which included several state-level and a few national-level standards documents (e.g., California Department of Education, Child Development Division, 2008; California Department of Education, Child Development Division, 2010; Pennsylvania Department of Education and Department of Public Welfare, Office of Child Development and Early Learning, 2010; U.S. Department of Health and Human Services, Administration for Children and Families, Office of Head Start, 2010) as well as key papers from developmental psychology and learning sciences (Brown & Kane, 1988; Duncker, 1945; Mischel, Ebbesen, & Raskoff Zeiss, 1972), into a set of key elements that most or all of our sources agreed were important for optimal development of young children. These elements spanned cognitive, social, emotional, physical, and academic categories of competency, so at first we were tempted to recapitulate these categories in our curriculum organization. But here, our lay-customer-facing context forced us to ask ourselves not how we as researchers might parse things but how we could most compellingly communicate the elements of our curriculum to busy parents of preschool-age children. Adopting this more pragmatic lens helped us to carve our curriculum into the following seven "clusters":

1. *Control Yourself*: This cluster includes executive function (De Luca & Leventer, 2008; Espy, 2004), emotional control, motor control, and patience (which, we admit, can be thought of as falling under executive function, but the concept is recognizable enough to parents that we thought it warranted separate mention).

2. *Figure Stuff Out*: This is our "problem-solving" cluster. It includes categories for understanding relationships, representations, the structure of the world, planning, and spatial reasoning.

3. *Acquire Physical Routines*: Kids have a lot to learn in the physical realm. We categorized elements in this cluster in terms of movement (e.g., pencil grip), space (e.g., body awareness), or tasks (e.g., washing hands).

4. *Be Creative*: This cluster includes divergent thinking (e.g., thinking of 10 different ways to use a popsicle stick), self-expression (painting, building, etc.), and generative thinking (e.g., thinking of 10 different things to do on a Saturday morning).

5. *Gather Necessary Knowledge*: This cluster captures what many people think of when they think of early learning: colors, shapes, ABCs, 123s, etc. One of our criteria for the success of our curriculum is that people who explore it come to understand that this cluster is only a small subset of what matters for young children's development.

6. *Love Learning*: This cluster captures such trendy psychological topics as deliberate practice (Ericsson, Krampe, & Tesch-Römer, 1993), grit (Duckworth, Peterson, Matthews, & Kelly, 2007), intrinsic motivation (Ryan & Deci, 2000), and growth mindset (Dweck, 2007).

7. *Interact with Others*: Of course, we do not live, learn, or develop in a vacuum. This cluster includes categories dealing with boundaries, communication, and other important elements of social interaction.

These seven clusters are the top level of a hierarchical curriculum that includes over 80 dimensions of learning. We believe that the curriculum does a fair job of describing all of the skills and knowledge children need in order to be prepared to learn well in all of the various formal and informal learning situations they may encounter as they grow. But it is *daunting*. As the reader may guess, our goal of producing a comprehensive and authoritative curriculum framework stands in tension with our goal of producing a curriculum framework that busy parents who are not experts in developmental psychology can understand. The straightforward names of our seven clusters should help, but we also decided to create a visualization to help parents navigate up and down through the levels of the curriculum framework. This visualization is designed to be used on tablets, as part of the same app ecosystem as our interactive animated stories for children (about which more will be said below). Figure 1 shows a drill down process from *interact with others* into *communicating*, which contains individual dimensions such as *verbal language comprehension* and *play entry skills*. Tapping on any of these individual dimensions will give the parent a brief description of that dimension and, if necessary, its relevance for early learning.

Why Go to all That Trouble?

As noted above, we are industry researchers creating interactive animated stories on tablets for preschoolers, along with a parental feedback and guidance framework. The games we incorporate into our stories serve as embedded assessments to measure learners' progress on relevant curricular dimensions (e.g., color identification or spatial reasoning). We can report that progress to parents and give them tips about how to support that progress outside of tablet time. Given this product model, why would we bother including curricular dimensions that cannot feasibly be measured in our games, such as the ability to hold a pencil correctly or verbally articulate one's needs?

There are a few reasons. First, as academic completists, we wanted to be sure we had considered all relevant aspects of early learning in our own research process. Once we had done so, we realized that we could use the breadth of the curriculum framework as a design support to help us think creatively about what we might possibly incorporate into gameplay. For example, we have created games to measure and foster turn taking, facial-emotion identification, and delay of gratification; developing workable game mechanics to support those dimensions was not easy, and it might not have occurred to us to try had we not kept the dimensions in our curriculum framework as we brainstormed game ideas.

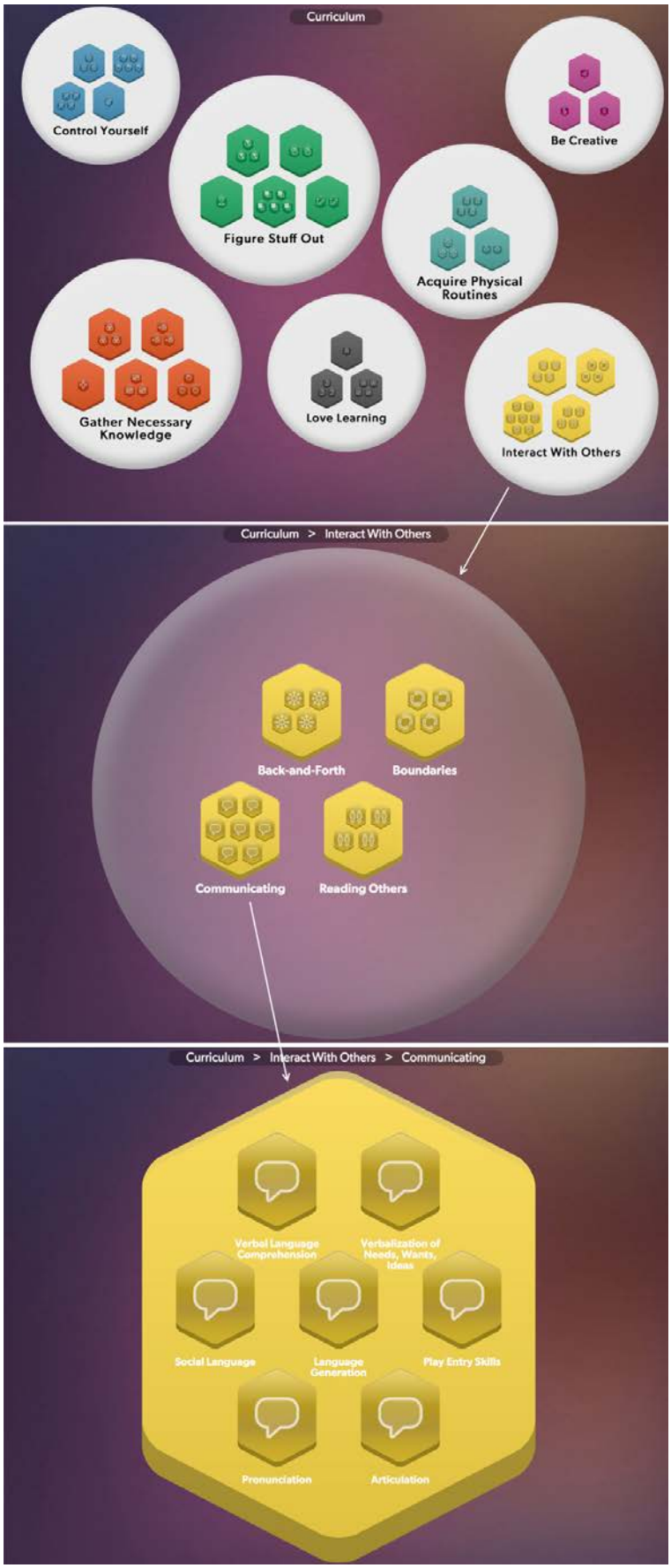

Figure 1: Curriculum Framework and Drill-down

Second, as a young startup trying to establish a brand identity, we recognize that our academic background can help differentiate us from our competitors. Being able to offer parents a complete picture of what their children will need to succeed as learners—even if that picture includes things we cannot directly support in our products—may help establish us as a trusted resource in the minds of those parents.

And third, we recognize that learning is an all-the-time activity. We create products for tablets because the affordances of these devices have made them a prominent part of the new-media landscape for preschoolers, but we recognize that most learning will (and should!) still occur in offline contexts. To effect real change in young learners' trajectories, our goal must be to create a connected learning ecosystem (Ito, 2013).

Three-Pronged Delivery Plan

The ecosystem we hope to create has three interwoven parts: our stories, our interactive elements, and offline parental support. The stories provide the narrative backbone for our curricular ecosystem. Each "appisode" in our product line is a tablet app containing a cartoon story, and each story has a theme, such as perseverance or divergent thinking. We use the stories to present aspects of our curriculum framework that are amenable to modeling (such as describing one's feelings or negotiating social conflicts) or direct instruction (such as teaching vocabulary in context).

Each story also has 4 to 6 games, puzzles, or other interactive elements incorporated organically into the story. For example, in the first story in our series, the main character is preparing to attend a friend's birthday party; as part of that preparation, he must build a present for his friend (which leads to a puzzle game) and make a birthday card (which leads to a painting activity). These interactive elements may measure learner achievement in a dimension (e.g., the puzzle game measures spatial reasoning and motor control) or simply support development in that dimension (e.g., the painting activity provides an opportunity for creative expression). Our design goal with these interactive elements is to keep them situated in the context of the narrative, so that learners always understand why they are doing various tasks and are motivated to succeed to propel the story forward.

Most of our interactive elements are embedded assessments that measure various curricular dimensions. We report those measurements to parents through an interactive dashboard (detailed discussion of which is outside the scope of this paper), and we offer specific research-based advice to parents about how to support their learner's progress in the relevant dimensions at home, in the car, etc. For example, we might measure a learner's ability to identify colors by name in the context of a hide-and-seek game or a rocket-fuel-mixing game and conclude that the learner consistently identifies primary colors but struggles with secondary and tertiary colors. And then in reporting that to parents, we might explain a recent research finding (Dye, 2010) suggesting that when teaching color names, it is better to say the color name after the object name rather than before (e.g., "the balloon is red" instead of "the red balloon").

This reporting-and-advice functionality feeds into the third part of our ecosystem, offline parental support, which is both the most important and the one over which we have the least control. Our stories, too, are intended to foster off-line parental support, insofar as learners' engagement with story elements can till the soil for future parental interactions. For example, a child who has just experienced an interactive story about helping characters to catch a magical fish may be more receptive to and prepared to learn about things like how animals play different roles in an ecosystem, the history of fishing, how different cultures catch and use fish differently, or even the physics behind a fishing-pole reel! In this case, the story creates a micro-interest that can parents can leverage to help the child learn about history, society, biology, or physics.

Reflections

Whether parents actively want technology-based education for their kids or simply recognize that their kids will use technology and that they may as well try to make those experiences as educational as possible, many parents today are exploring tablet-based early-learning options for their children. And regardless of people's opinion about the rightful place of technology in early learning, most agree that tablets can convey some lessons but not all. Parents want to understand how to support their learners, both within a new-media ecosystem and more broadly. These facts create a messaging opportunity. We have tried to design our curriculum framework to respond to this messaging opportunity by offering a way for parents to explore the space of early learning and to understand what is (and is not) important in this space. (We are continually surprised by how many parents stress about how quickly their three-year-olds will learn to read, for example, and we hope that many more parents will come to understand the importance of executive functions to their learners' long-term success.) And in light of our beliefs about connected learning, we have found the breadth of our curriculum to help us keep a broad view while we design various nodes of the network, which we hope will help those nodes fit more harmoniously into the whole.

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