Young Children, Apps & iPad

prepared by

Michael Cohen Group LLC
Principal Investigator and Evaluation Team
Ready to Learn

Research undertaken as part of the evaluation activities of the
U.S. Department of Education
Ready to Learn Program
Executive Summary

Background and Objectives  Touch screen technology has introduced a first generation of tools that afford remarkable access and potential for creative use. This study posits three hypotheses:
1. Touch screen technology allows younger children (two years old and older) to access and play productively with a sophisticated media technology platform;
2. Scientific knowledge is needed about how young children (ages two-to-eight) approach, play, and learn with touch screen devices as well as how children master the challenges of age appropriate applications (Apps);
3. Research is needed to identify the components that comprise the App anatomy, including the specific components that are salient for learning and creation of effective educational Apps.

The Michael Cohen Group LLC (MCG) is currently the evaluation partner for Project UMIGO* and Project LAMP**, two partnerships awarded Ready To Learn cooperative agreements in 2010 by the U.S. Department of Education. The focus of Ready To Learn is the optimal utilization of media for education. Both Projects UMIGO and LAMP are developing educational transmedia properties for children ages two to eight. MCG as evaluation partner is responsible for formative research to inform the creation of educational media properties as well as summative assessments of educational effectiveness of those properties.

These transmedia properties in development include the Apps for touch screen devices such as Apple’s iPad. iPads have been in the market for approximately a year and little research has been conducted on young children’s usage of touch screen devices. In order to best support LAMP and UMIGO and to contribute to the emerging body of literature on touch screen technology (in this study iPads), MCG has undertaken this study to explore young children’s and their caregivers’ perceptions and use of iPads and Apps.

Methodology  In order to address these hypotheses, MCG conducted qualitative research with sixty (60) children two-to-eight years old. Children participated in one-on-one in-depth interviews (IDIs) and observations. Parents/caregivers (in this study caregivers) participated in small focus group interviews (FGIs).

* WTTW (Chicago Public Television), WILDBRAIN Entertainment Inc., Michael Cohen Group LLC.
** Hispanic Information & Telecommunications Network (HITN), Callaway Digital Arts, Michael Cohen Group LLC.
and completed a survey questionnaire. Research was conducted during February and March 2011.

**Findings**  Children as young as two years old access, play and learn with touch screen devices. Children’s initial reactions are characterized by fascination and shaped by their developmental level, prior experience with technology, and the design of the App interface and game/play. Simply, iPad access and use are relative to the design of the App interface, game experience, and the fit between the App content and the child’s developmental level.

Findings also indicate that there are several types of learning that occur during App play. These include: the tacit learning of the game and how it works; mastering of explicit learning tasks (e.g., matching, counting) embedded in the game narrative; and the use of skills and models learned and applied to other types of games and levels of play. Engaging with creative App activities often shifts the child’s focus away from the subjective experience of winning or losing to a personal-best competition. Additionally, children progress quickly from novice to mastery when using a well-designed App.

The world of Apps currently designed for children includes three general types: gaming Apps, creating Apps and e-books. Children in this study prefer creating and gaming Apps. Specifically, children prefer gaming Apps whose interface afforded ready access and provided interactive games that are easy to learn and compelling to master. Creating Apps provide a set of tools for drawing and building. High appeal is based on children’s interest in making things in a no-fail environment with endless possibilities and outcomes. Additionally, the child’s experience is characterized by *learning by doing*, building on their existing skills and being motivated by their own interests.

Ideally, the use of digital tracking and analytics identifies the child’s level of mastery and provides feedback in the service of extending learning. At its best, touch screen technology offers a mode of interactive experience that mirrors the child’s natural constructivist learning.

An overview of child development in relation to iPad and App usage as well as questions for future research are detailed in the report.
Background

Touch screen technology has introduced a first generation of tools that afford remarkable access and potential for creative use among young children. Having been in the market for about a year, there is a small but emerging literature on the use and impact of touch screen tablets or iPads. This work on children’s usage of mobile devices and touch screens, combined with anecdotal reports from caregivers as well as clips posted on YouTube, all point to the widespread usage of touch screen devices by very young children.

The Michael Cohen Group LLC (MCG) is currently the evaluation partner for Project UMIGO and Project LAMP, two partnerships awarded Ready To Learn cooperative agreements in 2010 by the U.S. Department of Education. The focus of Ready To Learn is the optimal utilization of media for education. Both Projects UMIGO and LAMP are developing educational transmedia properties for children ages two to eight. These transmedia properties include development of Apps for touch screen devices such as Apple’s iPad. MCG, as evaluation partner, is responsible for formative research to inform the creation of educational media properties as well as summative assessments of educational effectiveness of those properties.

iPads have been in the market for approximately a year. To date, little research has been conducted on young children’s use of touch screen devices. In order to best support LAMP and UMIGO and to contribute to the emerging body of literature on touch screen technology, MCG has undertaken this study to explore young children’s and their caregivers’ perception and use of touch screen devices (in this study iPads), and Apps.

Objectives

The current study is designed to explore young children’s use of touch screen devices and currently available Apps, and contribute to the general body of knowledge on children’s use of touch screen technology. Specifically, the study is designed to increase understanding of the iPad’s potential for use as an educational tool by young children (two- to eight-year-olds).
The study posits three main hypotheses:

1. Touch screen technology enables young children (two years old and older) to access and play productively with touch screen devices.
2. Scientific knowledge is needed about how young children (ages two-to-eight) approach, play and learn with these new tools as they master the challenges of specific age appropriate Apps.
3. Research is needed to identify the component features that comprise the App anatomy including features most salient for consideration when designing educational Apps.

During the initial phase of research, observations of young children with iPads led to the formulation of additional questions and hypotheses, including: How do motor skills shape usage, and how do these skills develop through interaction with a touch screen device? How do children at different developmental levels understand an App interface? How do children at different developmental levels explore touch screen devices and Apps? What is the relationship between a child’s developmental level and an App game concept? How do developmental differences impact game comprehension and play? What are the features of an App interface and game mechanics that optimize access, play and learning? What curriculum is optimal for integration into App play? What are the criteria for evaluating App usability and educational potential?

**Methodology**

**Design.** In order to meet these objectives a qualitative research study with young children ages two-to-eight and their caregivers was designed. The study included in-depth interviews (IDIs) and observations of children using iPads, as well as small focus group interviews (FGIs) and completed questionnaires by most caregivers.

This study was conducted in two phases. Phase One was completed with children two-to-eight years old at a research facility. Children were recruited to represent equal numbers of experienced and novice touch screen users. Children were observed during IDIs, while their caregivers were interviewed separately in FGIs. All caregivers completed a pre-interview survey about their family’s media and technology ownership and usage, focused on touch screen devices and Apps. Phase Two was conducted with children two-to-eight years old in schools that serve low-income children.

**Sample.** A total of sixty (60) children participated. Children were recruited to represent three age groups: two-to-three, four-to-five and six-to-eight years of age, as well as equal gender distribution (29 boys and 31 girls). Participating children included a mix of both novice and experienced touch screen users. Approximately two thirds of the participating children live in lower
income families. Sixty-five (65) caregivers participated and completed a questionnaire on family media usage and thirty (30) caregivers participated in FGIs.

Research was conducted during February and March 2011 at three locations: a research facility in Manhattan and day care centers and a school in Bridgeport, CT, and Brooklyn, NY. Signed consent was obtained from all caregivers. MCG research professionals conducted all interviews and observations and analyzed all data. Data included interviews, questionnaires and structured observation logs completed for each child, documenting the details of the child’s approach to play with the touch screen device. A content and usage analysis of several specific Apps was conducted. Interviews and FGIs were recorded. The study was approved by an Institutional Review Board (IRB).

**Findings**

**Overall.** Overall findings are as follows:

1. Touch screen technology and accompanying digital Apps offer an accessible and meaningful media platform for children as young as two years of age;
2. Children’s initial reaction to touch screen devices is characterized by fascination and immediate engagement, and is shaped by: child’s developmental level, previous experience with touch screen devices, and the App interface design and game/play;
3. The iPad’s large size touch screen provides easy access and allows for sustained engagement;
4. Young children explore and learn in ways that are natural to them (touch, repeat, trial and error, ‘make silly things happen’);
5. Overall, children are enthusiastic about iPads. However, the device alone does not guarantee engagement and learning;
6. The App interface is as critical as the platform and needs to be intuitive in order to easily afford access;
7. Accessibility and use are relative to the App interface design, child’s prior digital gaming experience, and the relationship between the App design and child’s developmental level;
8. There is a sequential progression from novice to mastery;
9. Moving from novice to mastery occurs quickly with age appropriate Apps;
10. The progression from novice to mastery is often achieved within the first playtime with an iPad;
11. The risk of frustration and boredom is high unless game challenge is sustained through leveling.

**Detailed findings.** Detailed findings are represented in the following order:

1. Usage and learning in the context of developmental level;
2. Caregivers’ perceptions and attitudes;
3. Novice to mastery learning;
4. Learning and different types of Apps;
5. Barriers to use and learning;
6. Apps taxonomy.

Detailed findings by age group/developmental level are described in Appendix A.

**iPads Usage and Learning in the Context of Children’s Development.** The central themes of child development are familiar. Children progress from an immediate, concrete, sensory experience to a more conceptual and abstract understanding. The unfamiliar increasingly becomes familiar, and conceptual models for organizing experience evolve through trial and error, application and adaptation. In the context of iPad usage, children’s skills develop from novice to mastery when game play includes sequentially progressive levels and the child’s subjective experience is one of independence, autonomy and “doing it myself.”

iPads engage even very young children. Responsive to touch, iPads afford access with a sense of fun and the possibility of mastery.

From a developmental perspective iPad usage can be organized in six ability and preference categories. These categories include:

1. motor skills;
2. approaches to exploration;
3. game concept;
4. generalization of skills;
5. preferences for activities and designs;
6. comprehension of App interface.

The accompanying chart (see Appendix A) summarizes children’s experience at three developmental/age levels.

**Caregivers’ perceptions and attitudes.**

Novice caregivers with little touch screen experience express anxiety about their children using these devices, fearful that their child could access the Internet and inappropriate content. Additionally, App game play is not perceived as a constructive activity. Experienced caregivers who own and use touch screen devices readily introduce their children to the technology perceiving that children learn by "figuring things out." Many of the experienced caregivers regulate their children’s use of the touch screen devices.

Caregivers’ awareness of Apps educational content is limited. However, experience mitigates anxiety. Caregivers are enthusiastic, however, about the concept of App play that includes possibilities for learning and making things.

Caregivers perceived that Apps with greater value and an extended "shelf life" had the following characteristics:

1. Provide children opportunities to play and be entertained on their own;
2. Provide children opportunities to participate in digital activities that would otherwise "make a mess" or "get them into trouble," like splashing water in a pond or making cupcakes;
3. Provide children a rich game experience, with leveled play to sustain engagement;
4. Demonstrate children's progress through an interactive, embedded, and scaffolded curriculum;
5. Allow children to easily learn how to play, yet require effort to master—so that game play is neither frustrating nor boring.

Learning – From Novice to Mastery.
A pattern was identified in both children’s initial encounter with the iPad and Apps and their progress from novice to mastery.

Children are enamored with the fact that the device responds immediately to their touch. It is 'love at first swipe'. The feel of the device (the weight, glass screen, size) generated a positive visceral reaction. Novice children quickly progress from apprehensive to curious, to eager to explore.

The progression of iPad use often goes from hold, tilt, palm, push, drag, tap or swipe to progressively more targeted and differentiated moves. Additionally, once children understand the function of the Home button, they can move from App to App. Curiosity about other Apps increases as patience with the current App decreases. If the interface of an App is not intuitive or does not readily afford access, children will engage in trial and error efforts, and then quickly move on.

Children’s learning through App play takes several forms:
• the tacit process of figuring out the game and how to make it work for them;
• the gradual mastery of more explicit learning tasks embedded in the game narrative; and
• applying skills they have learnt to other levels or types of play.

This mode of interactive learning offers a microcosm of an optimal learning experience that involves active exploration, construction of solutions and learning explicit content.

Variables that influence use and learning from different Apps.
As children learn and master the iPad and Apps, there are a number of variables that impact their path and inhibit or engender progress or frustration. As stated, age and developmental
stage determines the kind of App and learning activity that is appropriate for each child.

Apps need to be age appropriate to be effective. A child’s prior experience impacts both the activity and the content that they find appealing. The transfer of learning from computer games, cell phones and other media is critical to iPad and App learning. The intuitiveness and rapidity with which children bring skills from other contexts to their iPad play and problem solving are significant and impressive. Trial and error exploration is central in this process. The acquisition of schemas from prior game play yields more successful process of exploring and mastering iPads and Apps.

App accessibility and playability vary widely. Examples of easily accessible Apps include Super Why!, Koi Pond and are characterized by a user-friendly interface. The navigational schema for other Apps is more opaque and as a result, more difficult for children to use (e.g., Cut the Rope, Tang and Tao, Jump Start).

Educational Apps, characterized by curriculum embedded in game play, are confronted with challenges. In many cases, children move from one App activity to another in rapid succession and in any order, so that learning and teaching a sequenced curriculum is impossible. However, levels and leveling re-introduce a sequenced curriculum. Doing it well is a challenge.

**Barriers to use and learning.**

Findings indicate that there are several barriers that inhibit use and learning. These include:

- App’s unclear, unfriendly or unresponsive user interface,
- game play that lacks reward or feedback,
- obscure game objectives,
- too many distractions,
- Apps that lack “palm rest”, where buttons trigger themselves if accidentally touched within play area.

App mechanics are a particularly salient feature due to children’s developing motor skills.

**Types of Apps and App Content.**

There are currently three categories of Apps for children: *e-books* in many forms, *gaming Apps*, and *creating Apps*. The following features are important for considering similarities and differences between these types:

- game play/mechanics or activity,
- characters,
- narrative as defined by game and as experienced by child,
- curriculum, both implicit and explicit.

**Gaming Apps** In *gaming Apps* the activity includes a range of challenges, actions and reactions that lead to skills acquisition, and achievement as levels are played and mastered. The game play itself is a learning system and
The curriculum is optimized if it is embedded in the activity.

**E-books** In reading Apps or e-Books the story or the reading of the story is the activity. Playful features or mini activities are integrated into a familiar schema of reading a book. The curriculum is in this context either explicit in the text or implicit and embedded in the activities.

**Creating Apps** Creating Apps provide tools, workspace and activities. (e.g. cupcakes, robots, painting, etc.)

Appeal derives from:
- No-fail environment,
- Child determines pace,
- Learning by doing,
- Tool use,
- Endless possibilities & outcomes,
- Children can build on what they like to do,
- Children’s interest determines use.

Curriculum is embedded in the tool use.

**Summary and Implications**

Findings indicate that children as young as two years old access, play and learn using touch screen devices. Touch screen technology and accompanying digital Apps offer an accessible and meaningful media platform for children:
- The iPad’s large touch screen provides easy access and allows for sustained engagement;
- Young children explore and learn in ways that are natural to them (touch, repeat, trial and error, make silly things happen);
- Overall, children are enthusiastic about iPads.
- However, the device alone does not guarantee engagement and learning.

The App interface design is critical. The App needs to afford access and support the player’s intuitions as they move through the entry screen to successive layers of the App content. The move from novice to mastery can be rapid with well designed, age appropriate Apps. The challenge is to sustain engagement through leveling, and simultaneously integrate educational content that is woven into the game activity. There is a considerable risk in alienating the user if category expectations are not met, navigation is difficult and counter intuitive, and/or game play is frustrating or boring.

App play and App experience takes place in the context and presence of many other Apps, which are visible on the screen. The larger context of the App marketplace differs from a traditional store or
the online purchase experience. Many items are free. The store is always open and available. The App competitive landscape is vast, but it is not well organized. Often purchases are impulse driven, based on word of mouth or an icon that depicts a favorite character. When a child is in the App store, immediate gratification is a click away. Apps face a similar challenge to other media platforms in that appeal and engagement must be maintained in a competitive context.

Findings indicate that we can identify and understand the features and anatomy of Apps. Additionally, educational Apps can be adjusted or shaped to optimize learning. The introduction of leveled play is a potential solution to the challenge of integrating a sequential curriculum and sustaining engagement. Findings indicate that embedded analytics can identify the appropriate challenge level for each child and provide the user (or caregiver) with an on-going progress report. Tablets or iPads provide access and engagement which, when experienced with optimal content and design, sustain young children’s play and learning. Currently, there are few examples of well designed educational Apps for young children.

The dynamics of App play have unique characteristics. Findings indicate that the engaging nature of App game play and creative activities shift the child’s focus away from the subjective experience of winning or losing. In App play the child engages in a personal-best competition. Furthermore, well-designed Apps provide children with feedback on their own progress and a sense of personal recognition.

Observation of young children’s behavior on iPads, including their rapid trajectory from novice to mastery, poses questions for future research. What are the similarities and differences between virtual and real life experiences? How closely is touch screen learning comparable to real life constructivist learning? How can educators optimally utilize touch screen technology and Apps? How can we integrate pre-school learning into Apps and their content? How can the design of scaffold challenges and leveling be responsive to a child’s learning and development? What is the best use of feedback, and how can embedded assessments support learners?
### APPENDIX A
iPad Use and Learning
Patterns Observed in Three Age Groups

<table>
<thead>
<tr>
<th></th>
<th>2- to 3-year-olds</th>
<th>4- to 5-year-olds</th>
<th>6- to 8-year-olds</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Motor Skills</strong></td>
<td>Big gesture exploration as if image is an object.</td>
<td>Gestures more directed and intentional. Initial press or drag evolves to tap and swipe with trial and error.</td>
<td>Quickly figure out the moves that work. If novice, may press too hard initially but soon tap and target accurately.</td>
</tr>
<tr>
<td><strong>Approach to Exploration</strong></td>
<td>Eager to &quot;make something happen&quot;. Want a response to their gesture.</td>
<td>Enjoy &quot;making things happen.&quot; Now try to figure things out using &quot;trial and error&quot; to explore.</td>
<td>Enjoy novelty of a new app. Pursue “the game”. Try and adapt familiar schemas.</td>
</tr>
<tr>
<td><strong>Concept of Game</strong></td>
<td>&quot;The game&quot; is about &quot;making things happen&quot;. Patterns of cause and effect are refined. Their goal is &quot;to do&quot; and create an effect.</td>
<td>Curious but concepts of &quot;game&quot; play are limited to familiar (match, target). Simple purpose, process and pay off work best. Enjoy making or drawing.</td>
<td>A &quot;game&quot; is expected. Want a purpose, process and way to improve (master level). Enjoy making things.</td>
</tr>
<tr>
<td><strong>Generalization of Skills</strong></td>
<td>Explore experientially, like an object in the world. How does it feel? What does it do?</td>
<td>Generalize schemas from play with toys or computers. Challenge to adapt their schemas to new game.</td>
<td>Generalize experience with games, gaming, and technology. More developed and flexible schemas.</td>
</tr>
<tr>
<td><strong>Preferences for Activities &amp; Design</strong></td>
<td>Familiar characters are attractive. Simple, colorful designs afford direct access and response.</td>
<td>Familiar characters engage. Intuitive and interactive design with some novelty appeal. “Winning” a level or making something sustains interest.</td>
<td>Moderate novelty fosters interest. A challenge to master in new ways (slicing fruit with a sword), or create in new ways sustain interest.</td>
</tr>
<tr>
<td><strong>Grasp of app interface – “what you see is what you get” vs “how do you get inside” and figure out the game?</strong></td>
<td>What they see/do is what they grasp as possible. Responsive, accessible. Fun interaction is key. Child may play the game in his or her own way.</td>
<td>What they see is where they begin to play. If access is intuitive, they try to figure it out. They may or may not actually play the game.</td>
<td>Interface understood as the starting point; a surface providing access. Will work to figure out the game and its levels.</td>
</tr>
</tbody>
</table>
Research undertaken as part of the evaluation activities of the U.S. Department of Education Ready To Learn Program

Research was funded by the U.S. Department of Education as part of the Ready To Learn program, award numbers U295A100016 and U295A100026. The contents of this report were developed under a cooperative agreement from the U.S. Department of Education. However, these contents do not necessarily represent the policy of the Department of Education, and you should not assume endorsement by the Federal Government.