



The Research Based Design of Kaplan Early Learning Company Shine™ Explorations on Multi-Touch Devices for Early Childhood Education

Research White Paper

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Executive Summary

Research provides us with many proven avenues to support young learners and prepare them for entering kindergarten. Chief among these strategies are:

- + Support for Social and Emotional Development
- + The Importance of Play
- + Engaging Children in Early Mathematical Experiences
- + Providing Collaborative Learning Opportunities

While these skills are not the only ones necessary to ensure school readiness, they are of major importance and provide the focus for this Research White Paper and are the basis of the design of the Shine™ Explorations software and multi-touch devices created by Kaplan Early Learning Company.

New technologies are now physically and intuitively accessible to young learners. Similar to earlier tools used in the preschool classroom, such as sand and water tables, these new tools expand the ways children can experiment and learn as they work together to develop social and emotional competencies, interact with engaging early math opportunities, and experience the joys and challenges of working collaboratively with others to enhance learning.

In a new study on technology mediated collaborative learning, researchers concluded that:

Because young children are mastering social learning, building collective agency is frequently complicated by impulsivity and conflict. The multi-touch table delivered a singular environment in which common goals were built into the activities providing an opportunity for individual and collective agency as well as social learning. Apps [Shine™ Explorations] included built-in goals all children could see as they manipulated apps, producing shared goals. (Karno & Hatcher, 2017)

The design of Shine™ Explorations used on multi-touch devices is based on current research about what matters most in early childhood education. By providing a structure and platform that supports early childhood educators in helping children develop social and emotional skills through open-ended play experiences and early collaborative learning experiences, Shine™ Explorations facilitates the abilities that children need to succeed in later schooling.

Research on Early Childhood Education: *What Matters Most?*

The field of early childhood education is relatively new. Until the early 1960s the focus on young children was largely on developmental milestones rather than educational interventions. In the 1960s scholars increasingly recognized the value of preparing children to enter formal schooling. They also recognized that the differing abilities of children under six followed them into kindergarten and beyond: those deficient in basic social and early academic skills would continue to face challenges in elementary school and beyond.

Researchers now recognize that support for social and emotional learning, providing tools and activities for open-ended play, giving children opportunities to conceptually explore early math, and encouraging children to collaborate and learn together with their peers are essential for helping children enter kindergarten prepared to thrive as learners.



Social and Emotional Development

Supporting positive social and emotional development in preschool provides the foundation for learning and succeeding in elementary school and beyond (Head Start, 2015). Kindergarten teachers report that about 20% of children entering kindergarten do not have the social and emotional skills to be “ready” for school. Research also demonstrates that for very low-income children this percentage is likely to be as high as 30 percent (Boyd et al., 2005).

Social development is defined as a child’s ability to have meaningful relationships with other children and with adults. Relationships with others provide children with the opportunity to practice skills and improve problem-solving capabilities as they learn to compromise and cooperate with others. Emotional development is defined as the child’s ability to express and manage emotions and recognize and respond appropriately to the emotions of other people. The preschool years are a crucial time for helping children learn to manage their relationships and build social skills.

Research indicates that there is a strong connection between children’s social and emotional abilities and school readiness (Willis & Schiller 2011). Teachers play an important role in fostering preschooler growth in these areas. In a review of the research on the emotional basis of learning and development in early childhood education, researchers found that social success is strongly connected to succeeding as a learner. Children who enter kindergarten with strong positive profiles in social and emotional development adjust much better to formal schooling and also have improved grades and achievement (Denham et al., 2013).

Emotional competence entails the ability to make and sustain friendships and initiate positive relationships with teachers. This results in children having more positive attitudes about school and participating more fully in learning and other activities at school. Emotional regulatory abilities also strongly factor into school success (Denham, et al., 2010).

In the past decade, educators and researchers are increasingly recognizing that there needs to be more training to help teachers create an atmosphere in preschool that supports strong social and emotional development. Evidence based practices for supporting development in these domains include:

1. Modeling genuine, appropriate emotional responses
2. Helping children to understand their own and others' emotions
3. Supporting children's regulation of emotions
4. Recognizing and honoring children's expressive styles while promoting appropriate expressiveness
5. Giving children many opportunities to experience the joys and to overcome the frustrations of new learning opportunities (Denhan et al., 2013)

Preschool teachers vary in their abilities to support social and emotional learning, and some do not view this type of support as inherent in their duties (Hyson & Lee, 1996). Current researchers call for the need to provide teachers with more evidence based tools that can help them support social and emotional development of preschoolers. Training and professional development activities also need to focus on this domain to help promote teachers' own social and emotional competencies so that teachers can better understand their role in promoting social and emotional learning in the classroom (Denham et al., 2013).

The Importance of Play

Most educators and researchers agree that play is an important component of early childhood education (Johnson et al., 2013). However, the recent emphasis on early learning standards and assessment has sometimes led policymakers to argue for more structure and direct instruction in early childhood education (Christie & Roskos, 2007). Researchers have begun to focus efforts on more clearly defining what is meant by the word "play" as they continue to explore the ways in which play is an important component of early learning.

Play is a complex phenomenon: The definition of play incorporates positive affect, the emphasis on process over product, intrinsic motivation, free choice, and non-literality (Johnson et al., 2013). Researchers and educators recognize play as important for fostering growth and development in self-regulation, social competence, early academics, physical well-being, problem-solving, and creativity (Johnson et al., 2013).

The strategic use of play in preschool settings to foster development in various school readiness skills includes a combination of adult emotional support, child initiation, self agency, cognitive challenges, and support for private speech as well as collaborative talk. Researchers have found a link between providing children with opportunities for well supported play and observing later positive and cooperative behaviors during required activities such as circle time and clean up (Elias & Berk, 2002).

Peer interactions during open-ended play can improve social skills, cooperation, and confidence building. Researchers found that when young children are able to drive play activities and pursue their own ideas there is more cooperation, rich language use, problem solving, and reciprocity (Broadhead, Howard & Wood, 2010). Play during preschool helps children to be more successful in their later school years because play can help them learn skills such as taking turns, following directions, and performing other tasks related to functioning effectively in the classroom. Play also supports emerging literacy and numeracy (Hirsh-Pasek et al., 2009).

Play continues to hold a valued place in the preschool curriculum. Teachers serve as important facilitators in encouraging appropriate play. Supporting teachers through curriculum, tools, strategies and professional development activities can help bring the research on what is known about play into the classroom to support learning and growth. New learning tools and technologies can help foster open-ended play when they are appropriately designed and supervised in preschool learning settings. The Fred Rogers Center recognizes that high quality digital media tools can help foster interactions among children and that, especially for children younger than age five, technology should promote interactivity and joint engagement peer-to-peer as well as child to adult (U.S. Department of Education, 2016).

Engaging Children in Early Math Experiences

The National Council of Teachers of Mathematics stated in 2000 that the foundation for children's development in math is established in the earliest years. The National Association for the Education of Young Children (NAEYC) also states that: "high-quality, developmentally appropriate mathematics education for children 3-6 is vital" (NAEYC, 2012).

Math learned in early childhood consists of:

- + Number sense: for example, "3" represents 3 objects and is less than 4
- + Geometry: for example, recognizing shapes and patterns
- + Measurement: for example distance and size
- + The language of math such as "equal to"
- + Spatial relations such as "in front of" or "far away"

Young children tend to be naturally curious about math and children use math by talking, playing and doing. Research shows that young children learn about math in a non-linear fashion as they experiment through play (National Mathematics Advisory Panel, 2008).

There is a significant amount of research that demonstrates that early math knowledge greatly influences subsequent learning. In a meta-analysis of six longitudinal data sets, children's early knowledge of math was found to be a more important indicator of overall school success by middle childhood than other data examined such as verbal, reading, attention, social or oral language skills (Duncan et al., 2007). Educators have been concerned for many years that socioeconomically disadvantaged children begin school with much less exposure and math knowledge than their middle-income peers (Jordan et al., 2006). Due to differences in the content and quality of communications about math between parents and children from different economic and cultural groups, preschool has become an important place for compensating for this deficit in exposure to math.

A fundamental skill that children need to learn in preschool is early number and operation sense. Instruction in numeracy assists children in making quantitative comparisons. Much of early number learning relates to providing children with the ability to make

comparisons between different objects, such as which pencil is longer (Sophian, 2013). Research support for focusing on the importance of quantitative comparisons leads educators to encourage children to use numbers to compare collections of items rather than just attaching a numerical value to a single collection of items. Using different types of numerical units can also help children better understand and generalize numerical relations (Sophian, 2013).

In early childhood, working with numbers and operations through engaging activities can provide children with an intuitive feel for how numbers are related and how they behave. Children develop this intuitive sense by connecting knowledge about numbers and operations (Baroody, 2006). Early childhood educators need tools for supporting preschoolers in developing informal math knowledge and thinking, because this is an area that is sometimes overlooked in preschool classrooms where teachers focus more on learning by rote: counting, reading and writing numerals, and reciting early operations such as "1 plus 1 makes 2." (Baroody, 2006).

New research has focused attention on the development of spatial skills and the link between these skills and math, and later success in science, technology, engineering, and advanced math (Wai et al., 2010). Children use spatial skills when working on puzzles, with blocks, or using interactive digital tools. Children with strong spatial skills typically also excel in math (Mix & Cheng, 2012). A new longitudinal test has been developed to measure spatial skills of 3 to 5-year-olds, and researchers have found that spatial experiences can play a strong role in children's math skills around the time that they enter kindergarten (Verdine et al., 2017).

Early math for preschool should include engaging children in one-to-one correspondence activities such as completing shape puzzles, or classifying and sorting objects into piles. Equivalence activities can also be included such as determining if two sets of objects have the same number. Research indicates that counting experiences are connected to extending young children's comprehension of numbers beyond their intuitive number sense (Fuson, 1992). There is also some evidence that pattern recognition can speed the development of the ability to move from intuitive number sense to the process of abstracting (Broody, 2006).

The frequency of experiences with high quality informal number related activities has been correlated to numerical knowledge measured by achievement tests (Klibonoff et al., 2006). A substantial body of research also indicates that preschool math performance is predictive of math achievement in later schooling (Sophian, 2013). Developmentally appropriate early math experiences need to be consciously supported by providing preschool teachers with information, training, and tools that support early math skills.

Providing Support for Collaborative Learning

The benefits of collaborative learning have been well established in research on learning success. Collaborative learning consists of learning that takes place when two or more students work together to solve a problem, develop a joint understanding, or complete a task together (Mercier et al., 2015). Until recently most researchers focused their studies on older children with the assumption that younger children were unable to truly work collaboratively to accomplish shared goals. In the last two decades researchers have taken a closer look at the role collaborative learning can play in early childhood learning and development. There is consensus among these researchers of the importance of collaborative activities in the learning process and that the essential component to successful collaborative learning activities for young children is appropriate teacher mediation (Gomez et al., 2013; Lara-Cinisomo et al., 2004).

Collaboration is currently viewed as an important component for school readiness (Lara-Cinisomo et al., 2004). School-readiness skills are the fundamental skills that children need to develop in order to be successful in elementary school (Astington & Pelletier, 2005). These skills include social abilities that help foster more specific proficiencies such as early literacy and numeracy (Ziv et al., 2008). Preschool has gained importance in serving as the place where the groundwork for developing social and collaborative skills can be learned. A recent study found clear benefits of collaboration on cognitive development for young children that were the same age. Collaborative activities were beneficial for improving visual perception, problem-solving, and rule-based thinking. The study also found that collaboration is particularly beneficial for lower-ability children who are working with higher-ability children (Sills et al., 2016).

While the benefits of helping children develop collaborative skills makes sense at any age, researchers have now documented the role collaborative learning plays in early social development. When children are able to develop an understanding of their own beliefs and intentions, along with understanding the beliefs and intentions of others, this impacts their social interactions (Carpendale & Lewis, 2006). As children learn the importance of working well with others toward common goals, and developing an understanding of another child's perspective, they are then better able to understand their own perspective on how to solve a problem (Gillies, 2006). Young children also are able to learn that the world exists independently of their own needs, and they begin to consider other points of views (Fawcett & Garton, 2005).

Developing collaborative skills in young children can be challenging for teachers. Providing teachers with specific strategies to promote collaborative learning activities and support the social and emotional learning of young children is essential. Teachers need to create a setting that promotes a supportive environment and help reinforce positive interactions between children in order to set the stage for collaborative learning to take place (Battistich & Watson, 2003). Researchers have started to investigate new technologies that provide computer mediated collaborative learning (Zurita & Nussbaum, 2004). While technologies can help set the stage and provide support and a location for collaborative learning to potentially take place, the role of the teacher is key in providing a classroom culture that promotes social and collaborative learning (Szewkis et al., 2011).

New Research on Technologies Designed for Early Childhood

As digital tools become more interactive and accessible for young children, researchers are taking a closer look at the potential benefits of digital tool use by young children. In a systematic literature review of 87 empirical studies on how technologies influence young children's learning the authors found that:

The majority of the reviewed studies revealed that the technologies had positive effects on children's performance across developmental domains. Particularly, in social domain [stet], most studies showed that technologies enhanced children's collaboration and interaction with others and their development of multiculturalism (Hsin et al., 2013)

In 2012 the National Association for the Education of Young Children and the Fred Rogers Center for Early Learning and Children's Media issued a joint position paper stating that when appropriately used with adult supervision, interactive technologies can provide valuable tools for early learning and social development. They state that:

Active, appropriate use of technology and media can support and extend traditional materials in valuable ways ... both cognitive and social" (NAEYC, 2012).

The report also stated that interactive technologies can be beneficial when they are based on solid research about how young children develop and learn. These new tools also need to provide educators with a structure to facilitate what matters most, such as support for social and emotional development, opportunities for open-ended play, providing early collaborative learning experiences, and the development of early math skills.



Digital Tools to Support Social and Emotional Development

Research has documented the ways that new digital tools can support social and emotional learning in young children by providing interactive experiences that promote peer to peer learning (NAEYC, 2012). Technology can also provide ways for children to connect to others through personalizing, saving, revisiting and sharing digital projects and experiences (NAEYC 2012; Bers & Kazakoff, 2013). Well designed tools provide support and scaffolding for appropriate use by early childhood teachers. When used intentionally, new tools can enhance the daily interactions and activities of preschoolers (Coppole & Bredekamp, 2009; NAEYC, 2012).

Dr. Bers, a researcher at Tufts University, states that:

New technologies make possible different kinds of learning opportunities, new ways for peer social interactions, and many possibilities for creativity, social and cognitive development.

Other researchers have noted that children are no longer passive consumers of technologies; they take an active role in creating and sharing information with others (Berson, 2003). Tools that are designed for a preschool classroom can facilitate social interaction among peers by encouraging peer learning, peer teaching, communication, and cooperation (Bers & Kazakoff, 2013).

Technologies for preschool that support interactivity, rather than drill and practice types of software, have been shown by researchers to foster communication and social development between peers. In research that compared children playing with Play-Doh and blocks versus children playing with a computer program, children spoke twice as many words per minute while using the computer (New & Cochran, 2007). In a related study, children spoke to their peers nine times as often when using a computer than when completing a physical puzzle (Muller & Perlmutter, 1985).

There is also evidence that children develop cooperative behaviors such as sharing and turn-taking when they use technology in small groups (Bergin et al, 1993). Digital games and interactive experiences can be extremely motivating because they engage children emotionally and behaviorally for longer periods of time than traditional teaching methods. Even children with ADHD, whose attention can frequently wander, have shown high levels of sustained attention to digital learning tools and games often due to the immediacy of feedback (Shute & Miksad, 1997).

Digital Tools to Support Play

Interactions with technology for young children should be playful and support exploration, pretend play, and active play (NAEYC, 2012). Children's use of new tools can be similar to their interactions with other learning tools at preschool such as blocks or manipulatives.

Research supports the appropriate use of new digital tools for young children that:

- + Support sensorimotor practice
- + Provide opportunities to explore in playful and creative ways
- + Allow children to control the outcome of the experience
- + Provide children with opportunities to explore the functionality of the tools (NAEYC, 2012)

Research has highlighted the importance of play in fostering growth and development in self-regulation, social competence, early academics, physical well-being, problem-solving, and creativity (Johnson et al., 2013). Digital tools that are designed to provide experiences in open-ended play in preschool settings can foster the development of school readiness skills and help children practice social skills such as taking turns and following directions.

Digital Tools to Support Early Math



The research based design of new digital tools for early learning is moving away from the drill and practice types of programs to technologies that promote content creation and problem solving. These new learning tools share an emphasis on constructionist learning environments that give children tools to construct open-ended learning activities (Resnick, 1986). These tools can provide children with engaging opportunities for spatial development and informal ways to learn about math reasoning and quantitative comparisons.

New interactive technologies can provide children with engaging and inventive ways to begin to understand one-to-one correspondence by completing digital shape puzzles, classifying and sorting objects into piles, or practicing equivalence activities such as determining if two collections of objects have the same number. Engaging technologies with proper teacher involvement can provide frequent practice with informal number related activities that give students the experiences they need to be ready to enter kindergarten.

In a 2014 report on math in early childhood and primary education the researchers point out that:

Digital technologies are the cultural tools of today's digitized society. Their role as mediators of human learning is increasingly more complex when one considers the range and scope of computational tools currently available. As mediating tools, they function as intellectual partners with learners in order to enable them to think in ways that otherwise they would not or could not (Dunphy et al., 2014).

Educators no longer question the use of tools such as calculators in advanced math learning or manipulatives in early math learning. By facilitating the ability of students, young or old, to learn by constructing knowledge, new digital tools can provide more than just engagement and time on task. Jonassen (1996) uses the term 'mindtools' to call attention to the power of digital tools to support knowledge construction. He argues that digital technologies should:

"not support learning by attempting to instruct learners but rather should be used as knowledge construction tools that students can learn with, not from."

Computer Supported Collaborative Learning (CSCL)

Computer Supported Collaborative Learning (CSCL) is a pedagogical approach that involves computer mediated social interaction among learners. Students share and construct knowledge together using a digital learning tool that is designed to support collaborative learning activities.

Collaborative learning is now seen as an important skill for children to begin to learn in preschool to be ready for the more formal education that begins in kindergarten. One of the key variables in implementing successful collaborative learning activities for young children is that the teacher creates a safe and supportive atmosphere to lay the groundwork for collaborative learning to occur. In addition, new research indicates that multi-touch devices such as table PCs or handheld tablet computers can provide support and mediation for collaborative learning activities to take place in early childhood education experiences.

Multi-touch devices were initially developed in the eighties, but have evolved significantly since that time. New multi-touch devices now offer more sophisticated input and processing mechanisms to allow users to interact with these devices in much more intuitive and natural ways. Because these newer devices are so intuitive, they have become a natural choice for early childhood education (Rideout, 2011). Multi-touch tables as well as tablet computers are particularly suited to young children because direct touching is used to select items on the screen rather than having to type commands. Also, young children find that the direct and rapid manipulation and incremental actions are particularly engaging on multi-touch devices (Schneiderman & Plaisant, 2004).

Prior to touch screen technologies, young children had difficulty using a mouse and keyboard connected to computers due to fine motor skill challenges and the absence of an intuitive interface (Nacher et al., 2017). Several studies have verified that multi-touch devices can be operated by children as young as 3-years-old, and that there appears to be no significant difference in learning between children playing with real objects versus children manipulating objects on a multi-touch device (Mansor et al., 2009; Sluis et al., 2004; Tyng et al., 2011).

One exciting new stream of research has been investigating how multi-touch tables can promote collaborative activities and support learning between peers (Gomez, 2013; Mercier et al., 2015). Research on elementary school-aged children using multi-touch tables indicates that groups are more task focused and their conversations are more interactive when they are using multi-touch tables than when they are using single-touch or paper-based activities (Mercier et al., 2015). In a qualitative study investigating the use of software designed for multi-touch screens researchers noted

that the size of the Engage 2 Multi-Touch Table was particularly well-suited to allow preschoolers to move around the table while interacting with their peers (Karno & Hatcher, 2017). While there have only been a few studies done investigating how multi-touch devices can promote collaborative learning, initial findings are encouraging (Jackson et al., 2013; McEwen & Dube, 2015).

Research using a social cognitive theoretical framework investigated how collective agency might be supported through a learning environment using a multi-touch table. This study found that the learning activity itself, Kaplan Early Learning Company Shine™ Explorations, helped foster collaborative activities and working toward common goals. The researchers concluded that the multi-touch table combined with the Explorations software fostered collaborative learning. They concluded:

Because young children are mastering social learning, building collective agency is frequently complicated by impulsivity and conflict. The multi-touch table delivered a singular environment in which common goals were built into the activities, providing an opportunity for individual and collective agency as well as social learning. Apps included built-in goals all children could see as they manipulated apps, producing shared goals. (Karno & Hatcher, 2017)

A joint position paper issued by the National Association for the Education of Young Children and the Fred Rogers Center for Early Learning and Children's Media stated that new interactive media, such as multi-touch tables, have the potential to resolve concerns that have been associated with children learning on single-use computers because these new devices support interactive and collaborative activities. The paper stated that:

Technology and interactive media are tools that can promote effective learning and development when they are used intentionally by early childhood educators, within the framework of developmentally appropriate practice to support learning goals established for individual children.

Also stated in the paper was that the teacher is the "lynchpin" in achieving appropriate and intentional use of interactive technologies and that educators are in need of positive examples on how to best use and integrate technology into learning.

Development of Fine Motor Skills with Multi-Touch Devices



Prior to the development of multi-touch devices, children under the age of five had challenges using technology. Keyboards and tracking pads used with laptops and traditional personal computers require fine motor skills as well as cognitive skills to understand symbols and letters on the keyboard. With the creation of multi-touch devices with intuitive screens younger children can more easily use these devices. (NAEYC, 2012).

Researchers have found that even children as young as two years old can interact effectively with multi-touch devices (Chiong & Shuler, 2010). Unlike interactions with traditional computers, young children can explore touchscreens such as multi-touch tables independently and make choices based on audio and visual prompts (Levine, 2011). Multi-touch devices provide young children with more control over their learning experiences and allow them to actively participate with the content presented on the device (Geist, 2014). Multi-touch tables in particular facilitate sharing and group activities as young children in a group can all interact around the table together (Karno & Hatcher, 2017).

Research on young children's use of tablet computers suggests that these devices provide opportunities for practice and refinement of skills for children with poor fine motor skills while providing an engaging experience that increases the chances that students will persevere when using these devices (Aronin, 2013). Researchers explored whether using the correct amount of pressure on a tablet might prove too challenging for young learners.

Their findings suggest that learning to use a tablet helped students develop fine motor skills and that children would persist in their attempts due to the strong motivational factors connected to using the tablet (Aronin, 2013).

Education specialists working with young children found that the light touch required by multi-touch devices appears to benefit young children who have not fully developed their fine motor skills as well as children with special needs who struggle with fine motor skill development. They reported that very little physical muscle strength was needed to operate a tablet (Saylor & Rodriguez-Gil, 2012).

The Research Behind Shine™ Explorations



The design of Kaplan Early Learning Company Shine™ Explorations educational software is based on current research about how young children best learn and develop and gain the skills needed to successfully enter kindergarten. Drawing on current research on best practices for early childhood education, Shine™ Explorations was designed to support children in the areas of social and emotional development, open-ended creative play experiences, early math skills, and opportunities to engage in early collaborative learning activities.¹

The overarching focus of the research design was for the Shine™ Explorations digital tools to be *exploratory*. Research shows that preschool learners need tools that support open-ended creative problem-solving and collaborative opportunities that support creativity. The essential skills that early learners need to be ready for

¹ Shine™ Explorations software is designed to support early learning in many areas including early literacy skills. This paper focuses on the areas of social and emotional development, open-ended play, early math skills, and computer supported collaborative learning.




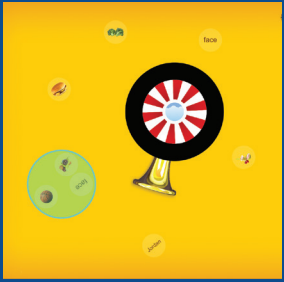



kindergarten include social and emotional development as well as early math and literacy skills. Each of the 10 Shine™ Explorations encourages children to be creative problem solvers, explore their natural curiosity, and engage in open-ended play. The design process of the Shine™ Explorations digital tools has also focused on devising ways to support teachers in providing engaging, interactive, and collaboration based activities most suited for young children.

In the early days of computers, preschoolers were largely left out of the mix: personal computers were mouse-driven, less intuitive, and often beyond the physical as well as intellectual abilities of young children. With the advent of multi-touch digital devices these new tools have become a natural place for children to experiment and create. Similar to earlier “technologies” in the preschool classroom, such as sand and water tables, multi-touch screens expand the possibilities of what children can experiment with and create.

The Kaplan Early Learning Company Engage-2 is a multi-touch table PC designed for early childhood. The table engages children as they learn new skills and explore together. It can be used as an activity center for small groups of three or four children or it can be shifted to a vertical position and used as an interactive display board. The 55 inch Inspire Plus and the 65 inch Inspire Ultra are 10 touch display tables that provide an interactive table surface or vertical board where 5 children can collaborate on learning activities.

This Research White Paper reviewed the following five Shine™ Explorations as used on the Engage-2, Inspire Ultra, and Inspire Plus multi-touch tables to verify the research base of these digital tools. Findings indicate that these Shine™ Explorations support social and emotional development, open-ended play, early math learning, and that they provide opportunities for collaborative learning. Details of approaches to learning that connect Shine™ Explorations with Early Learning Outcomes are listed in Table 2 at the end of this paper.

Table 1: Description of the 5 Shine™ Explorations Under Study

Shine™ Explorations*	
	<p>Puzzle</p> <p>Teachers can create fun puzzles from any picture or short video for the students in their class to put together. This explorations activity can be used for classroom scavenger hunts, reviewing field trips, or family engagement. It can also serve to extend what children are learning and support collaborative learning activities as well as social and emotional development. The teacher can add or delete media for puzzles and adjust the number of puzzle pieces and puzzle difficulty level.</p>
	<p>Group Bubbles</p> <p>Preloaded with four Content Packs, students can sort between animals, colors, emotions, and shapes. Teachers have access to word lists and images to customize their Group Bubbles learning experience and set up open-ended learning activities or more structured activities.</p>
	<p>Math Sentences</p> <p>Playing alone or with a friend, students practice math fluency by creating math sentences in Free Play, Longest Answer, and Fastest Answer modes. Teachers can control the range of solutions as well as the mathematical functions being practiced. This tool provides support for learning early math concepts and more advanced skills.</p>
	<p>Math Bubbles</p> <p>This exploration activity helps children develop early mathematical skills and learn a variety of math concepts, such as counting, classifying, sorting, grouping, adding, subtracting, dividing, and counting currency. The open-ended exploration featured on Math Bubbles engages students by allowing them to drag and place an assortment of animals and numbers into bubbles. Students must also discover how to make new bubbles and then learn how to join, separate, or pop bubbles. Teachers can also control the content and exploration difficulty.</p>
	<p>Insect Creator</p> <p>Insect Creator engages students by helping them learn about insects and their defining features while also creating them on screen. A variety of insect parts, such as thoraxes, wings, abdomens, and legs, will appear on the screen. Students can then collaboratively work to piece together animated insects that accurately represent real-life insects. The animated insects will also crawl around the screen once they are pieced together providing for open-ended play activities.</p>

There are 5 additional Shine™ Explorations. More information is available at: <https://www.kaplanco.com/Engage/>

Table 2: Early Learning Outcomes and Shine™ Explorations Multi-Touch Devices

Early Learning Outcomes	Approaches to Learning	Shine-2 Explorations
Support for Social and Emotional Development	<p>Social development:</p> <ul style="list-style-type: none"> • Supports child's ability to have meaningful relationships with other children and adults • Provides children with the opportunity to practice skills and improve problem solving capabilities as they learn to compromise and cooperate with others <p>Emotional development:</p> <ul style="list-style-type: none"> • Supports child's ability to express, regulate, and manage emotions • Supports child's ability to recognize and respond appropriately to the emotions of other people • Provides opportunities for children to experience the joys and overcome the frustrations of new learning opportunities 	<ul style="list-style-type: none"> ✓ Puzzle ✓ Group Bubbles ✓ Math Bubbles ✓ Math Sentences ✓ Insect Creator
Support for Open-Ended Play	<ul style="list-style-type: none"> • Supports strategic use of play in preschool settings to foster development in school readiness skills • Provides opportunities to explore in playful and creative ways • Allows children to control the outcome of the experience • Provides children with opportunities to explore the functionality of the tools • Provides scaffolding for teacher to encourage open-ended play activities • Includes a combination of adult emotional support and child initiation • Supports self agency, cognitive challenges, and support for private speech as well as collaborative talk • Emphasizes process over product and intrinsic motivation 	<ul style="list-style-type: none"> ✓ Puzzle ✓ Group Bubbles ✓ Math Bubbles ✓ Math Sentences ✓ Insect Creator
Support for Early Math	<ul style="list-style-type: none"> • Tool provides developmentally appropriate math education including opportunities for developing informal math knowledge and thinking • Tool supports non-linear exploration and play to foster early math skills • Tool supports quantitative comparisons and working with different types of numerical units • Tool supports early childhood educators in supporting preschoolers in developing opportunities to experiment with math concepts • Tool supports development of spatial skills and pattern recognition • Tool supports one-to-one correspondence activities such as classifying or sorting objects into piles 	<ul style="list-style-type: none"> ✓ Math Bubbles ✓ Math Sentences
Support for Collaborative Learning	<ul style="list-style-type: none"> • Tool provides opportunities for children to learn in groups of two or more and work together to solve a problem, develop a joint understanding, or complete a task together • Tool provides teachers with specific strategies to promote collaborative learning activities • Tool provides opportunities for interactive activities that foster communication and social activities 	<ul style="list-style-type: none"> ✓ Puzzle ✓ Group Bubbles ✓ Math Bubbles

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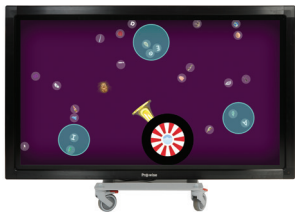
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