LINGOKIDS

EFFICACY STUDY

Children's Learning from Lingokids Plus and Basic Versions

University of California Davis
Dr Drew Cingel & Alison Snyder
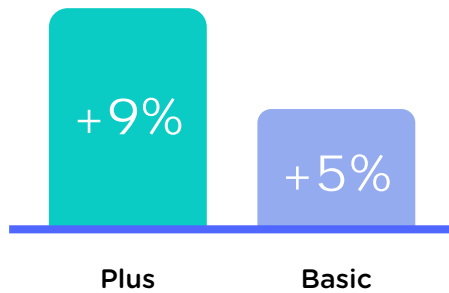
Summary Statements

**1** Lingokids Plus improves literacy, math and SEL skills by 9% in 8 weeks.

2 Lingokids Basic improves literacy, math and SEL skills by 5% in 8 weeks

+9% Plus

+5% Basic

3 Lingokids Plus is 2 times more effective at preparing children for Preschool than a Basic subscription (in 8 weeks)
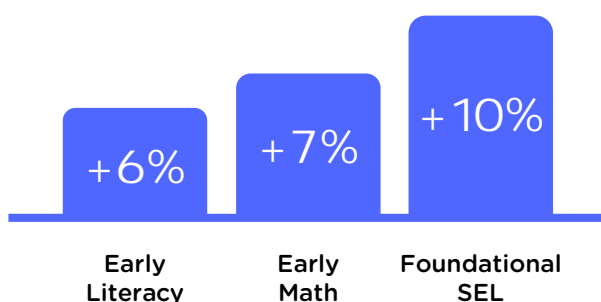
E Basic

2E Plus
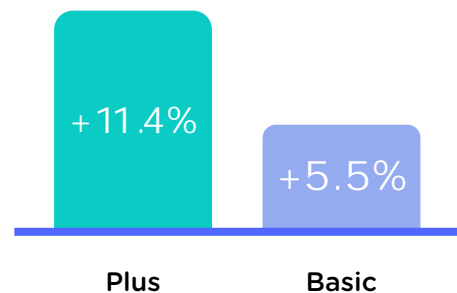
*E: Effectiveness

4 Lingokids improves early literacy skills by 6% in 8 weeks.

5 Lingokids improves early math skills by 7% in 8 weeks.

6 Lingokids improves foundational SEL skills by 10% in 8 weeks

+6% Early Literacy

+7% Early Math

+10% Foundational SEL

7 Lingokids Plus improves early literacy skills (vocabulary) by 7.6% (as a comparison, it is 2.5% in Basic).

+7.6% Plus

+2.5% Basic
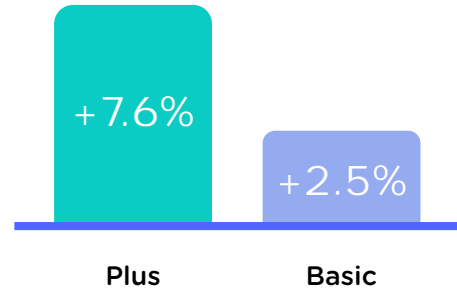
Lingokids Plus is about 3 times more effetive in increasing children's vocabulary scores compared to the Basic version.

E Basic

3E Plus

*E: Effectiveness

8 Lingokids Plus improves foundational SEL skills by 11.4% (as a comparison, it is 5.5% in Basic).

+11.4% Plus

+5.5% Basic

Lingokids Plus is about 2 times more effetive in increasing children's SEL skills compared to the Basic version.

E Basic

2E Plus

*E: Effectiveness

University of California Davis

Dr. Drew Cingel & Allyson Snyder

Abstract

The goal of the present study was to test preschool-aged children's (ages 3-5; M_{age} = 3.96 years) learning over time from one of two versions of the *Lingokids* app; the *Basic* and the *Plus* versions. Children (N = 35) participated over the course of eight weeks in a preschool setting, and played individually on tablet computers during their free time. Children played a minimum of 15 minutes per day for at least three days per week over the course of the eight-week study. We expected that trajectories of vocabulary, math, and socio-emotional learning (SEL) would be greater among children in the *Plus* condition, given that this version of the app allowed children the opportunity and agency to select the games they wanted to play, and repeat games they enjoyed, thereby strengthening learning. We found that, among children in the *Plus* condition, vocabulary, math, and SEL scores increased significantly over the eight-week period. Children in the *Basic* condition improved in all subjects, but only significantly in math scores. Therefore, while children in both conditions did exhibit gains in learning, children in the *Plus* condition showed more statistically significant growth in vocabulary and SEL, and broader growth across three indicators of early childhood learning.

1.

Children's Learning from Two Versions of the Lingokids App

Children who start kindergarten with a strong background in literacy, numeracy, and social-emotional skills have more academic success and engage more at their schools (Denton, West, & Walston, 2003). As preschoolers (generally ages 3-6) engage with more digital media (Rideout & Robb, 2020), it is important to leverage this media use to support children's learning and subsequent well-being. Existing research has primarily focused on comparing learning from media to learning from physical materials or comparing learning from interactive media to learning from passive media. Further, extant studies typically focus on one domain of learning (such as learning numbers) at a time. Little attention has been paid to how the design of interactive media (such as through promoting or inhibiting choice in what children are able to do, or the order in which they are able to engage with certain content) specifically can support children's learning in each of these domains. The current longitudinal experiment with preschoolers (ages 3-5) addresses these gaps in the literature by examining how using one app (with many different games) can support gains in vocabulary, math, and SEL scores, and how this learning can differ based on the design of the app (e.g., whether the app allows children to choose the games they want to play, or whether they follow a set path of games). Extant theory about children's learning from interactive media suggests that interactivity in and of itself should support learning through mimicking social interaction or being more engaging (Kirkorian et al., 2016). Because researchers have not yet examined how differing designs of interactive media may best support children's learning, theory has not yet focused on the finer details of digital game design for children. As such, we consider the Theory of Interactive Media Effects (TIME Model; Sundar et al., 2015) within the context of supporting children's school readiness. Further, we discuss implications for designing interactive media for young children.

2.

Theory of Interactive Media Effects (TIME Model)

The TIME model suggests that differences in affordances (potentials for action) catalyze cognitive and behavioral change that produce media effects. One type of affordance considered in the TIME model is an affordance of choice, or the ability to select content. The affordance of having a choice in content should prompt users to make content selections. When users do not have this option, they cannot engage in the action of selection, thus the affordance of choice itself requires different action possibilities (i.e., choosing content or not). These action possibilities then have psychological correlates, such as a sense of autonomy, defined as the degree to which a user has the control to pursue their own goals and actions (Sundar, Jia, et al., 2015). Research on adults has demonstrated that using interactive media increases feelings of autonomy (e.g., Jung & Sundar, 2022; Molina & Sundar, 2020), and researchers also suggest that the presence of choice fosters feelings of autonomy (Assor, 2012; van der Kaap-Deeder et al., 2017). Aligned with research on interactive media use as well as the TIME model, we hypothesize:

Hypothesis 1

Children in the choice condition (Lingokids Plus) will report a greater sense of autonomy while using the app than children in the no-choice condition (Lingokids Basic).

Further, the TIME model suggests that greater engagement is thus associated with changes in knowledge and behavior, but these associations have not yet been tested longitudinally nor with children. Further, the measures used on research with adults about knowledge acquisition typically measure specific content knowledge gained from reading an article or other text-based media. Thus, when assessing children over time and on domain-general knowledge, rather than content-specific knowledge, findings may demonstrate a clearer relation with knowledge acquisition. Absorption, a facet of engagement (defined as a psychological state in which users are involved cognitively or emotionally with a task; Oh & Sundar, 2015) is closely associated with media enjoyment (Agarwal & Karahanna, 2000). Though research has not yet examined the relations between media engagement and enjoyment on young children's learning outcomes, research in education does demonstrate that school engagement (Lei et al., 2018; Pietarinen et al., 2014) and enjoyment (Morris et al., 2019) are positively associated with academic achievement, which often includes knowledge acquisition (Allen, 2005). Finally, in the context of early childhood education, autonomy in the learning process is linked to greater interest in learning and knowledge acquisition (Grolnik & Ryan, 1987). Therefore, if children feel more choice and autonomy in the *Lingokids Plus* condition, it is likely they will also experience greater gains in learning.

Hypothesis 2

Children in the choice condition (Lingokids Plus) will have greater learning gains in (a) vocabulary, (b) math skills, and (c) social-emotional knowledge than children in the no-choice condition (Lingokids Basic).

3.

Method

Children (ages 3-5; N = 35; M_{age} = 3.96 years) at a local preschool in Northern California played with the app *Lingokids* for eight weeks (3x/week at 15 minutes each time; approximately six hours of total time spent using the app). Four children dropped out of the study, resulting in a final sample of 31 children. Children were predominately boys (n = 21; 67.74% of sample) and were diverse in terms of race/ethnicity (n = 14 White [45.16%]; n = 7 Asian [22.58%]; n = 6 Mixed-Race [19.35%]; and n = 4 Hispanic/Latino/a [12.90%]). Children were randomly assigned to play *Lingokids* in either the *Basic* or *Plus* versions. The application was downloaded to a personal tablet device for each participating child, which had their name on it. In this way, children played on the same tablet each day, ensuring that we could collect back-end user data for each child. Children kept the tablet computers as compensation for their participation.

Before children had access to the app, they were assessed on their vocabulary, math skills, and SEL. We also assessed vocabulary, math skills, and SEL after the eight-week study, using the same measures. Children completed a validated measure of receptive vocabulary (e.g., children were asked to point to a picture of a target word, such as 'castle' out of a choice of three images). For math skills, children completed a number identification task (e.g., which of the following are numbers?), a number comparison task (e.g., which of these two numbers is larger?) and a counting task (e.g., four items are placed in a bowl; the research adds two more and asks the child how many items are in the bowl). For SEL, children were asked to identify the emotions depicted by characters in drawings. Next, researchers read a story and asked children how the character was feeling in different scenarios (e.g., after receiving a gift for their birthday). Finally, children completed a measure of agency by pointing to their level of agreement of a number of sentences (e.g., "I felt in charge while playing *Lingokids*").

Pre-testing revealed that children who would play with the free version of the app were slightly older, scored higher on vocabulary, and were better at number recognition. As such, we focus on the growth of each group (*Basic* and *Plus*) rather than comparing their skills directly.
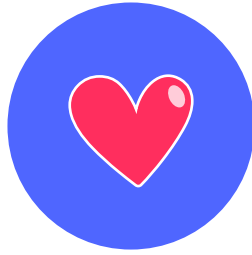
4.

RESULTS
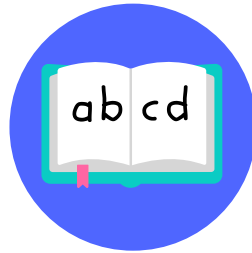
Vocabulary: Paired samples t-tests demonstrated that there was a significant change in vocabulary scores after eight weeks (M = 4.17 new words; SD = 5.26) for children using *Lingokids Plus* ($t(17)$ = 3.36, p = .004), while there was not a significant change for children using the free version of the app (M = 1.38 new words; SD = 4.82; $t(12)$ = 1.04, p = .32). Thus, vocabulary scores for children in the *Lingokids Plus* condition increased by 7.6% over the eight weeks, compared to a 2.5% increase among children in the *Lingokids Basic* condition.
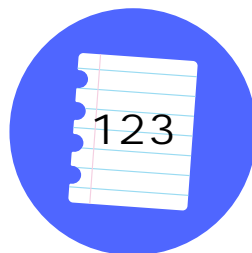
Math Skills: Paired samples t-tests demonstrated that both children in the Basic and Plus conditions had significantly higher math scores after the eight-week intervention than before. Children in both the free (M = 1.92, SD = 2.33; $t(12)$ = 2.98, p = 0.01) and Plus (M = 1.89, SD = 2.74; $t(17)$ = 2.92, p = .009) improved in math by completing around 2 more math problems correctly after the intervention. Thus, math skills among children using both *Lingokids Plus* and *Lingokids Basic* increased by over 7% in the eight-week period.

SEL: Paired samples t-tests demonstrated that there was a significant change in SEL after eight weeks for children using *Lingokids Plus* (M = 3.19 more questions correct after intervention; SD = 5.32; $t(15)$ = 2.40, p = .03) while there was not a significant change for children who played with the free version of the app (M = 1.54; SD = 3.76). Therefore, SEL increased among children using *Lingokids* Plus by 11.4%, compared to a 5.5% increase among children in the *Basic* condition.

Sense of Agency: One important part of learning is a sense of agency, or feeling like one has control. Children were asked about their experiences with the app, and they answered questions about if they felt like they could choose the game they wanted to play, if they felt like they were the leader, and if they felt like they could play how they wanted to. Children who played *Lingokids Plus* reported a stronger sense of agency related to the app (M = 3.52 on a 4-point scale, SD = 0.55) as compared to children in the Basic condition (M = 2.89, SD = 0.90, $F(1,28)$ = 5.65, p = .02).

5.

Additional Analyses with Back-End User Data

Time and Game Completion: It is important to note that children in both conditions played for approximately the same amount of time ($F(1,44) = 0.005$, $p = .95$), had similar rates of completion of the games ($F(1,26) = 3.31$, $p = .08$), and completed a similar number of games in total ($F(1,26) = 0.03$, $p = .87$), suggesting that the actual experience of playing and the content contributed to the differences in learning outcomes, rather than the number of games played or the total time spent playing.

Repetition: Children who played *Lingokids Plus* repeated games more frequently ($M = 2.07$, $SD = 0.46$) than children in the free condition ($M = 1.59$, $SD = 0.17$; $F(1,26) = 11.95$, $p = .002$). To be sure, only children in the *Lingokids Plus* condition had the opportunity to choose their own games, but it is clear that children did choose to repeat games when possible.

6.

Discussion

In summary, both hypotheses were supported. Children who engaged with the *Lingokids Plus* version of the app reported a significantly higher sense of agency when using the app, compared to children who engaged with the *Lingokids Basic* app. Further, children who used *Lingokids Plus* showed statistically significant gains in vocabulary, math skills, and SEL, while children in the *Lingokids Basic* condition showed only statistically significant gains in math skills (and smaller, non-significant gains in vocabulary and SEL) over the course of the eight-week study. Our data thereby suggest that *Lingokids Plus* contributes to greater and more consistent gains in learning for vocabulary, math skills, and emotion knowledge (including recognizing emotions and understanding others' emotions) for children in preschool (ages 3-5) as compared to children using the Basic version of the app. These differences are not due to a difference in quality of content (children in both conditions played approximately the same number of games and for approximately the same amount of time, and the content in the Basic and premium versions is the same) but rather due to the actual experience of playing the game and having the opportunity for repetition, which should aid in teaching new skills. Children who played *Lingokids Plus* reported a greater sense of agency while playing the game than children who played the free version. They also repeated games more often than children who played with the free version. As noted, both feeling a sense of agency in the learning process (Grolnik & Ryan, 1987), and increased opportunity for content repetition (Crawley et al., 1999; Mares, 2006) are associated with greater gains in children's learning. Therefore, in line with the TIME model (Sundar et al., 2015), *Lingokids Plus* is designed in a way that better promotes children's agency and opportunities for repetition, with commensurate success in teaching vocabulary, math skills, and SEL over an eight-week study among 3-5-year-old children in an American preschool setting.

7.

References

Agarwal, R., & Karahanna, E. (2000). Time flies when you're having fun: Cognitive absorption and beliefs about information technology usage. *MIS Quarterly*, 665–694. https://doi.org/10.2307/3250951

Allen, J. D. (2005). Grades as valid measures of academic achievement of classroom learning. *The Clearing House: A Journal of Educational Strategies, Issues and Ideas*, *78*(5), 218–223.

Assor, A. (2012). Allowing choice and nurturing an inner compass: Educational practices supporting students' need for autonomy. In *Handbook of research on student engagement* (pp. 421–439). Springer.

Crawley, A. M., Anderson, D. R., Wilder, A., Williams, M., & Santomero, A. (1999) . Effects of repeated exposures to a single episode of the television program Blue's Clues on the viewing behaviors and comprehension of preschool children . *Journal of Educational Psychology*, 91, 630 – 637. https://doi.org/10.1037/0022-0663.91.4.630

Denton, K., West, J., & Walston, J. (2003). *Reading - Young children's achievement and classroom experiences: Findings from the condition of education, 2003.* National Center for Education Statistics.

Grolnik, W. S., & Ryan, R. M. (1987). Autonomy in children's learning: An experimental and individual difference investigation. *Journal of Personality and Social Psychology, 52*(5), 890-898.

Jung, E. H., & Sundar, S. S. (2022). Older adults' activities on Facebook: Can affordances predict intrinsic motivation and well-being? *Health Communication*, *37*(5), 597–607. https://doi.org/10.1080/10410236.2020.1859722

Kirkorian, H. L., Choi, K., & Pempek, T. A. (2016). Toddlers' Word Learning From Contingent and Noncontingent Video on Touch Screens. *Child Development*, *87*(2), 405–413. https://doi.org/10.1111/cdev.12508

Lei, H., Cui, Y., & Zhou, W. (2018). Relationships between student engagement and academic achievement: A meta-analysis. *Social Behavior and Personality: An International Journal*, *46*(3), 517–528.

Mares, M.-L. (2006). Repetition increases children's comprehension of television content - up to a point. *Communication Monographs, 73*(2), 216-241. https://doi.org/10.1080/03637750600693464

Molina, M. D., & Sundar, S. S. (2020). Can mobile apps motivate fitness tracking? A study of technological affordances and workout behaviors. *Health Communication*, *35*(1), 65–74. https://doi.org/10.1080/10410236.2018.1536961

Morris, T., Dorling, D., Davies, N., & Davey Smith, G. (2019). *School enjoyment at age 6 predicts later educational achievement as strongly as socioeconomic background and gender.* SocArXiv; SocArXivPaper. https://osf.io/preprints/socarxiv/e6c37/

Oh, J., & Sundar, S. S. (2015). How Does Interactivity Persuade? An Experimental Test of Interactivity on Cognitive Absorption, Elaboration, and Attitudes: Persuasive Effects of Interactivity. *Journal of Communication*, *65*(2), 213–236. https://doi.org/10.1111/jcom.12147

Pietarinen, J., Soini, T., & Pyhältö, K. (2014). Students' emotional and cognitive engagement as the determinants of well-being and achievement in school. *International Journal of Educational Research*, *67*, 40–51. https://doi.org/10.1016/j.ijer.2014.05.001

Rideout, V., & Robb, M. B. (2020). *The Common Sense census: Media use by kids age zero to eight.* Common Sense Media.

Sundar, S. S., Go, E., Kim, H.-S., & Zhang, B. (2015). Communicating Art, Virtually! Psychological Effects of Technological Affordances in a Virtual Museum. *International Journal of Human-Computer Interaction*, *31*(6), 385–401. https://doi.org/10.1080/10447318.2015.1033912

Sundar, S. S., Jia, H., Waddell, T. F., &Huang, Y. (2015). Toward a theory of interactive media effects (TIME) four models for explaining how interface features affect user psychology. *The Handbook of the Psychology of Communication Technology*, 47–86.

van der Kaap-Deeder, J., Audenaert, E., Vandevelde, S., Soenens, B., Van Mastrigt, S., Mabbe, E., & Vansteenkiste, M. (2017). Choosing when choices are limited: The role of perceived afforded choice and autonomy in prisoners' well-being. *Law and Human Behavior*, *41*(6), 567. https://psycnet.apa.org/doi/10.1037/lhb0000259

LINGOKIDS

October 2024