

Happy Numbers Logic Model

Study Type: ESSA Evidence Level IV

Prepared for:
Happy Numbers

Prepared by LearnPlatform:
Molly Henschel, Ph.D., Senior Researcher
Meetal Shah, Ph.D., Senior Researcher

October 10, 2022

Updated September 7, 2023



EXECUTIVE SUMMARY

Happy Numbers engaged LearnPlatform, a third-party edtech research company, to develop a logic model. LearnPlatform designed the logic model to satisfy Level IV requirements (*Demonstrates a Rationale*) according to the Every Student Succeeds Act (ESSA).

Logic Model

A logic model provides a program roadmap, detailing program inputs, participants reached, program activities, outputs, and outcomes. LearnPlatform collaborated with Happy Numbers to develop and revise the logic model.

Study Design for Happy Numbers Evaluation

Informed by the logic model, the next phase will focus on planning for an ESSA Level III study to examine the extent to which usage of Happy Numbers impacts student math achievement. The proposed research questions are as follows:

1. During the 2022–2023 school year, what is the average number of tasks completed by students on Happy Numbers?
2. Do students who complete more tasks on Happy Numbers have higher math achievement?

Conclusions

This study provides results to satisfy ESSA evidence requirements for Level IV (*Demonstrates a Rationale*). Study design and planning is currently underway.

TABLE OF CONTENTS

Introduction	3
Logic Model	4
Study Design for Happy Numbers Evaluation	8
Conclusions	8
References	9

Introduction

Happy Numbers engaged LearnPlatform, a third-party edtech research company, to develop a logic model. LearnPlatform designed the logic model to satisfy Level IV requirements (*Demonstrates a Rationale*) according to the Every Student Succeeds Act (ESSA).¹

Happy Numbers recognizes that half of U.S. high school students are not ready for college-level mathematics at time of enrollment, and the trajectory of college students who lag behind their peers in mathematics begins as early as elementary school. Happy Numbers was designed to assist teachers with math instruction through differentiated, individualized math instruction.

The study had the following objectives:

1. Define the Happy Numbers logic model and foundational research base.
2. Draft an ESSA III study design.

Previous Research. Individualized instruction and support has many benefits, but can be challenging to achieve in the classroom given teachers' multiple responsibilities. A possible solution is whether teachers' use of tablets or laptops in 1:1 classrooms can provide students with adequate time, attention, and support. A meta-analysis of 15-years worth of research studies found that, on average, 1:1 laptop instruction positively impacted student achievement in English, writing, mathematics, and science (Zheng, Warschauer, Lin & Chang, 2016). Further, this study also found other student benefits including increases in: student technology use, student-led instruction, student engagement, and student-teacher relationships. More recently, a study on Happy Numbers, a 1:1 instructional tool, found that students showed increased math proficiency with more usage of the individualized intervention (Happy Numbers, 2022).

Happy Numbers functions as a "teacher assistant" in classrooms to help teachers adapt instruction to the individual needs of their students while freeing up their time to work with other groups of students. This individualized approach is very important given student learning and their level of potential growth. According to Vygotsky (1934), there is a zone between problems that a student can solve on their own and those that they cannot solve without assistance, known as the Zone of Proximal Development (ZPD). Happy Numbers uses technology to determine a student's zone for PreK-5 math skills and provides the student with appropriate guidance when solving problems. The effectiveness of this approach has been developed and validated through empirical research, such as the studies about the developmental progression of teaching numbers and operations to students as well as other mathematical domains (Frye et al., 2013).

¹ Level IV indicates that an intervention should include a "well-specified logic model that is informed by research or an evaluation that suggests how the intervention is likely to improve relevant outcomes; and an effort to study the effects of the intervention, that will happen as part of the intervention or is underway elsewhere..." (p. 9, U.S. Department of Education, 2016).

Early elementary students are beginning to comprehend and apply mathematical concepts such as logical or operational thought (Piaget, 1936). Happy Numbers adopted multiple approaches and best pedagogical practices to support this pivotal point in their development including concrete-pictorial-abstract approach (Bruner, 1964), multiple representations (Ainsworth, 1999; Ball et al., 2008), and connecting concepts. Developing this conceptual understanding and making connections to mathematical concepts across different representations or interpretations ensures that students gain a deep understanding of math concepts and fluency. By exposing students to progressively challenging exercises accompanied by positive feedback, including the ability to try new strategies, Happy Numbers can help students develop a “growth mindset,” which eventually leads to higher achievement (Dweck 2006; 2015)

Logic Model

A logic model is a program or product roadmap. It identifies how a program aims to impact learners, translating inputs into measurable activities that lead to expected results. A logic model has five core components: inputs, participants, activities, outputs, and outcomes (see Table 1).

Table 1. Logic model core components

Component	Description	More information
Inputs	What the provider invests	What resources are invested and/or required for the learning solution to function effectively in real schools?
Participants	Who the provider reaches	Who receives the learning solution or intervention? Who are the key users?
Activities	What participants do	What do participants do with the resources identified in Inputs? What are the core/essential components of the learning solution? What is being delivered to help students/teachers achieve the program outcomes identified?
Outputs	Products of activities	What are numeric indicators of activities? (e.g., key performance indicators; allows for examining program implementation)
Outcomes	Short-term, intermediate, long-term	<p>Short-term outcomes are changes in awareness, knowledge, skills, attitudes, and aspirations.</p> <p>Intermediate outcomes are changes in behaviors or actions.</p> <p>Long-term outcomes are ultimate impacts or changes in social, economic, civil or environmental conditions.</p>

LearnPlatform reviewed Happy Numbers resources, artifacts, and program materials to develop a draft logic model. Happy Numbers reviewed the draft and provided revisions during virtual meetings. The final logic model depicted below (Figure 1) reflects these conversations and revisions.

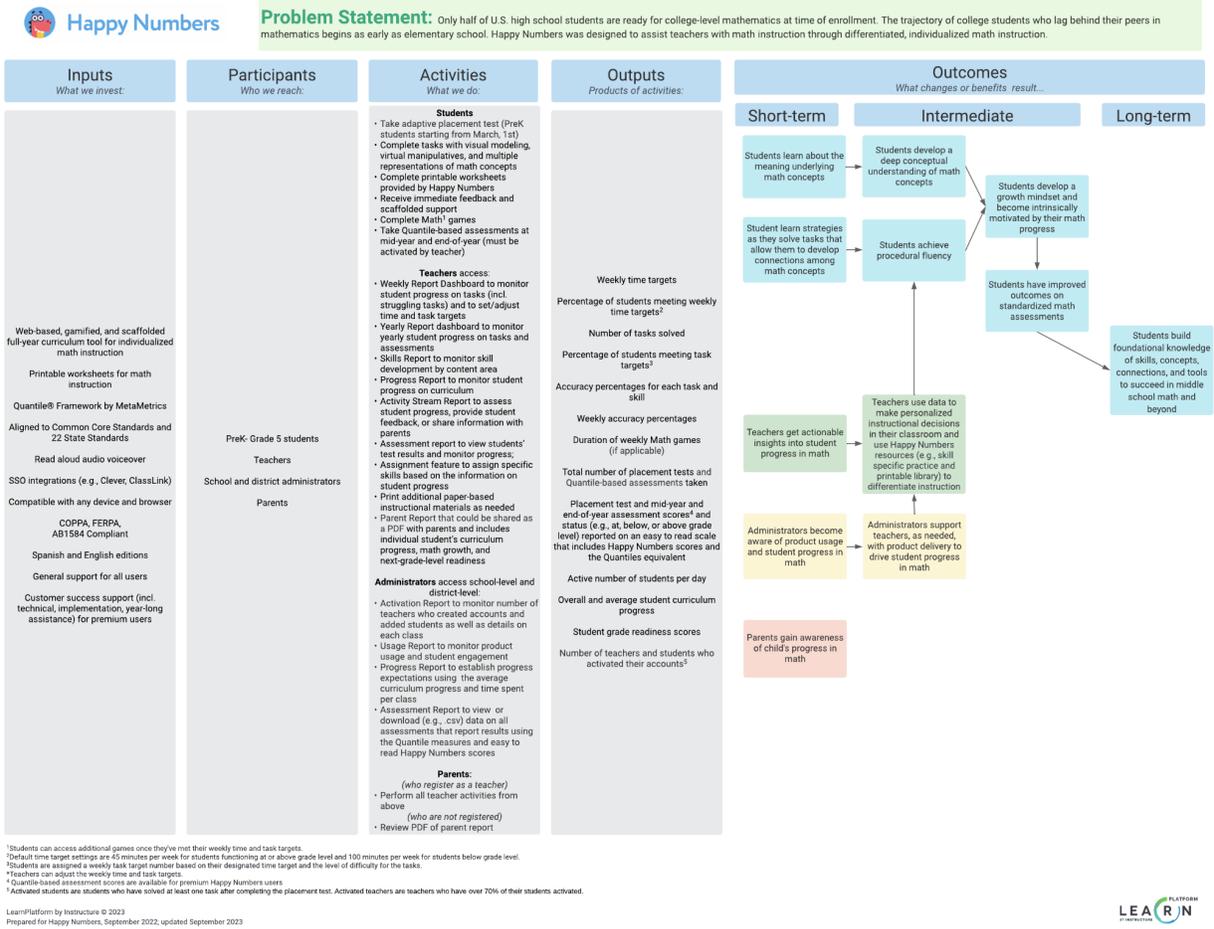


Figure 1. Happy Numbers logic model

Happy Numbers Logic Model Components. Happy Numbers, a web-based, gamified, and scaffolded full-year curriculum tool for individualized math instruction, invests several resources into their product, including Quantile® Framework by MetaMetrics; alignment to Common Core Standards and 16 other state standards; read aloud audio voiceover; single sign on (SSO) integrations (e.g., Clever, ClassLink); device and browser compatibility; COPPA, FERPA, and AB1584 Compliance, Spanish and English editions; general support for all users; and customer success support (including technical, implementation, year-long assistance) for premium users.

Using these program resources, PreK-Grade 5 students, teachers, school and district administrators, and parents can engage with the Happy Numbers platform in the following activities:

PreK-Grade 5 Students

- Take adaptive placement test (PreK students starting from March, 1st)
- Complete tasks with visual modeling, virtual manipulatives, and multiple representations of math concepts
- Complete printable worksheets provided by Happy Numbers
- Receive immediate feedback and scaffolded support
- Complete Math games²
- Take Quantile®-based assessments at mid-year and end-of-year (must be activated by teacher)

Teachers access:

- Weekly Report Dashboard to monitor student progress on tasks (including struggling tasks) and to set/adjust time and task targets;
- Yearly Report dashboard to monitor yearly student progress on tasks and assessments
- Skills Report to monitor skill development by content area;
- Progress Report to monitor student progress on curriculum;
- Activity Stream Report to assess student progress, provide student feedback, or share information with parents;
- Assessment report to view students' test results and monitor progress;
- Assignment feature to assign specific skills based on the information on student progress; and
- Parent Report that could be shared as a PDF with parents and includes individual student's curriculum progress, math growth, and next-grade-level readiness.

Administrators access school-level and district-level:

- Activation Report to monitor number of teachers who created accounts and added students as well as details on each class;
- Usage Report to monitor product usage and student engagement;

² Students can access additional games once they've met their weekly time and task targets.

- Progress Report to establish progress expectations using the average curriculum progress and time spent per class; and
- Assessment Report to view or download (e.g., .csv) data on all assessments that report results using the Quantile measures and easy to read Happy Numbers scores.

Parents

(Who register as a teacher)

- Perform all teacher activities from above

(who are not registered)

- Review PDF of parent report

Happy Numbers can examine the extent to which core activities were delivered and participants were reached by examining the following quantifiable outputs:

- Weekly time targets
- Percentage of students meeting weekly time targets³
- Number of tasks solved
- Percentage of students meeting task targets⁴
- Accuracy percentages for each task and skill
- Weekly accuracy percentages
- Duration of weekly Math games (if applicable)
- Total number of placement tests and Quantile[®]-based assessments taken
- Placement test and Quantile[®]-based mid-year and end-of-year assessment scores⁵, status (e.g., at, below, or above grade level), and Happy Numbers scores on an easy to read scale
- Active number of students per day
- Overall and average student curriculum progress
- Student grade readiness scores
- Number of teachers and students who activated their accounts⁶

If implementation is successful, based on a review of program outputs, Happy Numbers can expect the following short-term outcomes. Students may learn about the meaning underlying math concepts as well as learn strategies to develop connections among those concepts. In the short-term, teachers, administrations, and parents are expected to get actionable insights into student progress and administrators should become more aware of product usage.

In the intermediate, students should develop a deep conceptual understanding of math concepts and achieve procedural fluency, which in turn, allows students to develop a growth mindset and become intrinsically motivated by their developmental progress in math. Thus, students will have

³ Default time target settings are 45 minutes per week for students functioning at or above grade level and 100 minutes per week for students below grade level.

⁴ Students are assigned a weekly task target number based on their designated time target and the level of difficulty for the tasks. Teachers can adjust the weekly time and task targets.

⁵ Quantile[®]-based assessment scores are available for premium Happy Numbers users

⁶ Activated students are students who have solved at least one task after completing the placement test. Activated teachers are teachers who have over 70% of their students activated.

improved outcomes on standardized math assessments. Teachers are able to use data from Happy Numbers to make personalized instructional decisions in their classrooms and use Happy Numbers resources (e.g., skill specific practice and printable library) to differentiate instruction. In the intermediate term, administrators can support teachers with product delivery to help drive student progress in math.

In the longer term, Happy Numbers expects students to build the foundational knowledge of skills, concepts, connections, and tools needed to succeed in middle school math and beyond.

Study Design for Happy Numbers Evaluation

To continue building evidence of effectiveness and to examine the proposed relationships in the logic model, Happy Numbers has plans to conduct an evaluation to determine the extent to which its program produces the desired outcomes. Specifically, Happy Numbers has plans to begin an ESSA Level III study to answer the following research questions:

Implementation Question:

1. During the 2022–2023 school year, what is the average number of tasks completed by students on Happy Numbers?

Student Outcome Question:

2. Do students who complete more tasks on Happy Numbers have higher math achievement?

Conclusions

This study satisfies ESSA evidence requirements for Level IV (*Demonstrates a Rationale*). Specifically, this study met the following criteria for Level IV:

- ✓ Detailed logic model informed by previous, high-quality research
- ✓ Study planning and design is currently underway for an ESSA Level III study

Acknowledgements

The authors would like to extend their deepest thanks to Sarah Whipp who supported the preparation of this report in numerous ways.

References

- Ainsworth, S. (1999). The functions of multiple representations. *Computers & Education*, 33, 131-152.
- Bruner, J.S. (1964). The Course of Cognitive Growth, *American Psychologist* 19(1):1-15
- Ball, D.L., Thames, M.H., & Phelps, G. (2008). Content knowledge for teaching: What makes it special? *Journal of Teacher Education*, 59(5), 38–407.
- Dweck, C.S. (2006). *Mindset: The new psychology of success*. New York: Random House.
- Dweck, C.S. (2015). Carol Dweck revisits the growth mindset. *Education Week*. 35(5).
- Frye, D., Baroody, A.J., Burchinal, M., Carver, S.M., Jordan, N.C., & McDowell, J. (2013). *Teaching math to young children: A practice guide*. Washington, DC: National Center for Education Evaluation and Regional Assistance (NCEE), Institute of Education Sciences, U.S. Department of Education.
- Happy Numbers (2022). Happy numbers' impact on student math achievement. Retrieved from <https://shared.happynumbers.com/Research-overview.pdf>
- Piaget, J. (1936). *Origins of intelligence in the child*. London: Routledge & Kegan Paul.
- Vygotsky, L.S. (1934). *Thought and Language* (Revised translation of Myshlenie i Retz: Cambridge MA: MIT Press, 1986)
- Zheng, B., Warschauer, M., Lin, C.H., & Chang, C. (2016). Learning in one-to-one laptop environments: A meta-analysis and research synthesis. *Review of Educational Research*, 86(4), 1052–1084.