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## ACHIEVEMENT UNLOCKED: DIGITAL GAMES AS A KEY FOR LEARNING

*A Whitepaper for K-12 Parents, Guardians, Family  
Members, and Educators*

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This whitepaper is a collaboration between BrightBytes Labs and co.lab and is written for PK-12 parents, guardians, family members, and educators interested in learning more about the potential of digital games for learning, the key criteria that can inform game selections, and the benefits of effective school-startup partnerships.

co.lab is an accelerator that works with startups leveraging the power of digital games to build transformative educational technologies for PK-12 students and teachers. @playcolab

BrightBytes Labs is the research engine that drives BrightBytes' data analyses. @BrightBytesLabs

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## INTRO: DIGITAL GAMES FOR LEARNING? REALLY?

Aren't games a distraction? Isn't time spent on game play wasted time? Is gameplay rewiring children's brains? These are the types of questions that come up when adults observe children playing mobile games (Common Sense Media, 2013; Richtel, 2010).

What if we asked a different set of questions when we observed young people playing mobile games or expressing an interest in playing them? What if we asked specific questions about the learning goals for these games? In particular, what if we sought out games that provide adaptive and accelerated learning experiences for students, as well as access to real-time student assessment data for teachers? What if we tapped into games that, by their very design, leverage social and mobile technology to encourage academic achievement as well as the development of skills like persistence and collaboration?

Educators, game designers, researchers, and students have been discovering that games designed for learning have the potential to meet these goals. They're finding that well-designed educational games aren't a distraction. Instead, they can serve as vehicles that support the types

of teaching and learning practices that can set students up for success.

## I. POTENTIAL OF DIGITAL GAMES FOR LEARNING

Well-designed educational games can offer incredible possibilities for teaching and learning. In particular, they can engage students in ways that remove age- and grade-level restrictions on when students can learn. They can also help teachers focus their efforts on teaching in ways that support every learner. Finally, games can provide the right environment for diverse groups of learners to collaborate and persevere.

The three vignettes that follow illustrate the power of digital games for learning.

### ENGAGED TO LEARN

Lucy (pseudonym) is learning that she likes math. In fact, she likes it so much that she's spent the past few nights learning about linear equations, a topic in algebra. Lucy's spent nearly two hours practicing the skills and learning the concepts associated with this topic, and her work has paid off.

At first, Lucy's success may not seem surprising. Linear equations are a common topic in most algebra courses. Most high school students take algebra and many

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of them take it in 9th grade. The difference for Lucy is that she's in kindergarten, rather than high school. In addition, Lucy gained her skills while playing DragonBox, an algebra game that relies on algorithms developed by researchers at the University of Washington (Long, 2013).

Lucy was one of 4,000 students involved in a research study aimed at determining whether students in K-8 could master linear equations by playing DragonBox. It turns out that 93% of them did and that this group included 1st graders and kindergarten students like Lucy (Long, 2013). Unlike traditional forms of instruction, engaging games can motivate students to learn on their own, allowing them to push past age- and grade-level restrictions on learning.

Moreover, games can provide learning experiences that not only enhance students' subject knowledge, but also improve their attitude toward learning. For example, a recent study revealed a 10% improvement in Los Angeles 5th graders' attitudes toward math after using educational game app, Motion Math's Fractions! (Riconscente, 2013). Educational games can truly be game changers for learning.

#### **BUILT-IN ASSESSMENTS**

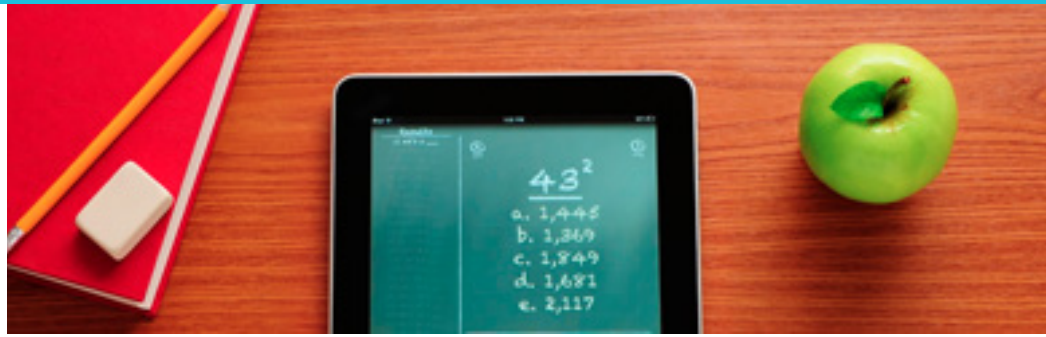
Gabriel (pseudonym) organizes

his students into working teams for today's genetics lesson. Each team's task is tied to team members' strengths and gaps from previous assessments. As the groups work through their tasks, Gabriel gathers data on students' thought processes, where they get stuck, and whether they can apply new skills to novel situations. Novelty, in particular, offers an added challenge, since well-designed games often provide more open-ended and complex learning experiences than more traditional instructional methods.

Gabriel can conduct these analyses because his students are immersed in an online educational game. The game, developed at MIT, allows teachers to "monitor [student] progress over time" in order to understand, in data-driven ways, what students know and can do (Schwartz, 2013). These game-embedded assessments provide the feedback needed to inform teaching and learning in real time (Three Things Games Designers Need to Know about Assessment, 2013).

As a result, Gabriel doesn't have to speculate or wait until each assignment's been graded. He doesn't have to take time out from teaching to give a test he then needs to grade in order to gain insights into how each student is doing. Instead, teachers like

*"A recent study revealed a 10% improvement in Los Angeles 5th graders' attitudes toward math after using educational game app, Motion Math's Fractions!"*



Gabriel can spend their time analyzing data from students' educational game play in order to plan future learning experiences more effectively. Such immersive, formative assessments can accelerate student progress by providing key information for planning subsequent instruction (Molnar & Cavanagh, 2013).

### CULTIVATING PERSISTENCE

Vanida and Seth (pseudonyms) are building houses in an online game called Minecraft. Vanida's house is filled with cartoon drawings, while Seth's is filled with jewel-encrusted treasure chests.

Vanida and Seth are both in 2<sup>nd</sup> grade. While they live in the same state, they have never met each other in person. Sometimes they work together to build structures. When they get stuck on how to build something new, they chat online with each other and with Minecraft peers, watch YouTube videos, and search for relevant resources online.

Games like Minecraft encourage perseverance. Motivated by their design tasks and engaged by the building process and the collaborative nature of the game, students persist even when they don't know how to proceed. They stick with the challenge and leverage feedback within the game, in order to

improve (MindCET, 2013). Such games encourage the kind of autonomous learning we continually seek for our students (Rheingold, 2013). Likewise, they encourage creativity and teamwork, as young people share their designs, get feedback, and learn with each other (Rock, 2013).

Clearly, games have the potential to increase student engagement in ways that remove age- and grade-level restrictions on learning. They also provide teachers with information to enhance their teaching practice. In addition, digital games can awaken levels of creativity and persistence students never knew they had. Given the advantages that digital games for learning can provide, what should teachers, parents, family members, and guardians look for when selecting games for learning?

## II. WHAT TO LOOK FOR WHEN SELECTING GAMES FOR LEARNING

Across the country and around the world, teachers, parents, and guardians of young people like Lucy, Vanida and Seth grapple with decisions about games and learning. The number of games and apps marketed as "educational" grows each day, and it can be difficult for teachers and parents to keep up.

*“Games have the potential to increase student engagement in ways that remove age- and grade-level restrictions on learning.”*



In fact, most parents report being familiar with only “some” of the games that their children play (Cummings & Vandewater, 2007). To further complicate matters, many supposedly educational games can fail to live up to their promises of providing effective, enjoyable learning (Habgood & Ainsworth, 2011). Given these factors, it’s unreasonable to expect parents and teachers to be familiar with all the games on the market that support learning.

### DESIGN ELEMENTS THAT SUPPORT TRANSFER

When working in an emerging field like educational games, it’s impossible to generalize about quality without placing limits on the possibilities of future innovation. With that caveat in mind, we propose a series of design elements that parents and teachers should consider when looking for learning games that promote student development. These elements, informed by decades of research in instructional design, support a student’s ability to use what they’ve learned in a game *outside of the game*. In short, this is called “transfer” (Bransford, et.al, 2000).

Learning games should help us get better at life, not just the games themselves. In essence, if a game doesn’t help you improve

your behavior *outside of the game*, then it doesn’t facilitate useful learning.

So, as parents and teachers make decisions about the types of games learners should play, the elements that support transfer must be at the forefront. Otherwise, we’ll end up with superior gamers who can’t use their skills when they need them most.

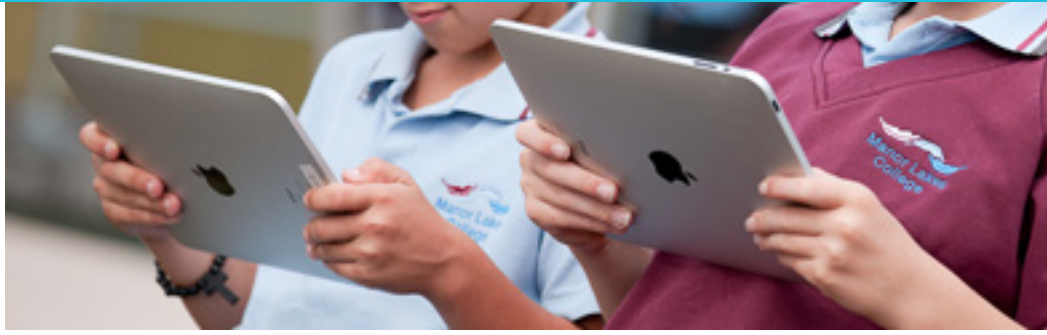
Research has shown that the following elements support a learner’s ability to transfer what they’ve learned into real life situations:

#### Simulations

Simulations allow gamers to practice new skills in a variety of different ways. This increases the likelihood that learners will be comfortable using newly learned skills outside of the game (Squire, 2006). Look for games that allow students to solve specific problems as a character in a specific situation. For example, a painting activity in Kidaptive’s Leo’s Pad app challenges young students to wait patiently as other (simulated) characters take turns using a shared paintbrush. This simulated sharing opportunity helps students develop self control as well as social skills that will help them succeed in kindergarten classrooms.

“Learning games should help us get better at life, not just the games themselves.”





### Social Elements

Learning is social (Vygotsky, 1978). Collaboration is one of the most desirable skills for college and career, and games that encourage learners to interact with each other result in greater learning outcomes (Adams, 2009). Look for games that allow learners to interact with others in team-based play. For example, in Pluto Media’s Koala Band players explore an online social environment inhabited by other characters with whom they can interact and invite to play mini-games designed to spark their interest in music and creative expression. There are also opportunities to use mobile devices to extend social play into the real world—Motion Math’s Questimate! utilizes a “pass and play” interface that allows players to create their own questions then practice estimation with friends on a shared device.

### Constant, Customized Feedback

Feedback is information provided to learners about their performance. It can accelerate learning in any context, but it’s especially effective in games (Hattie, 2008). Look for games that constantly give learners customized feedback on their progress. For example, LocoMotive Labs’ Todo K-2 Math Practice allows students to practice elementary math concepts through

activities scaffolded across a wide developmental spectrum. Feedback is provided constantly through both visual and auditory channels as the app adapts to a wide range of learner abilities.

On the following page we have provided a table that summarizes what teachers and parents should “look for” when selecting learning games that help students build skills applicable to school and life.

*“Collaboration is one of the most desirable skills for college and career, and games that encourage learners to interact with each other result in greater learning outcomes.”*



Design Element	Why It's Important	Specific Examples
Simulations	They provide safe spaces for students to practice what they've learned in many different ways.	<ul style="list-style-type: none"> <li>• Students have to solve a problem as a specific character</li> <li>• Students have to tackle the same problem in different locations, settings, or contexts.</li> <li>• Students have to use what they've learned in the game to solve new and different problems as the game progresses.</li> <li>• Ex: SimCityEDU, iCivics Games, Leo's Pad</li> </ul>
Social Elements	They help students retain what they've learned and develop team skills.	<ul style="list-style-type: none"> <li>• Students have to work with someone else before they can "win" or move forward in the game.</li> <li>• Students have to interact with real and virtual people to learn skills or content.</li> <li>• Students have to balance individual goals with the goals of the group in the game.</li> <li>• Ex: Minecraft, World of Warcraft, Koala Band, Questimate!</li> </ul>
Feedback	It helps students refine their understanding through adaptive and responsive gameplay.	<ul style="list-style-type: none"> <li>• Students receive customized feedback about their performance at least every 5 minutes of gameplay.</li> <li>• Students are given opportunities to practice and learn from their mistakes.</li> <li>• Ex: DragonBox, Todo K-2 Math Practice</li> </ul>





### III. THE POWER OF PARTNERING WITH STARTUPS

As students like Lucy, Vanida and Seth move through elementary, middle, and high school, they'll have lots of opportunities to continue learning through play. The hope is that their game play and the deep learning that accompanies it don't stop at the school door.

Some schools and districts are finding that, by opening their doors to educational game startups, they're integrating the positive effects of educational games with in-school learning. They're finding that schools and game designers can solve problems and rethink solutions by partnering with one another to effect change.

In fact, the potential for startups to add value to the education space is already making headlines.

#### CREATING VALUE FOR BOTH PARTNERS

The rapid iteration that's part of startup life and product design is increasingly becoming part of the educational landscape. Teachers and school leaders adjust quickly as challenges, like shrinking budgets, new technologies, and new standards enter the picture. Some schools are inviting

startups in, so that school leaders, students, and startup teams can learn from each other. These types of interactions can create value for teachers and students as well as early stage educational game developers.

When companies and schools agree to partner, they gain opportunities to learn from one another, in order to improve products and platforms for learning. For example, Summit Public Schools, a Bay Area charter network, and Clever, a fast-growing startup that connects learning software to a school's central database, recently did just this (Deane, Browne, & Carroll, 2013).

Learning game companies like Motion Math and Toontastic have undertaken similar efforts. With permission from school leaders and teachers, entrepreneurs from both startups not only gained incredible feedback from students and teachers but also shared lessons they'd learned during the development process. For example, entrepreneurs talked with students and teachers about what it takes to build a company, to lead a team in working toward a goal, and to go from idea to actual game (Young, 2013).

*“When companies and schools agree to partner, they gain opportunities to learn from one another, in order to improve products and platforms for learning.”*



### SOLVING PROBLEMS THROUGH INNOVATION

Startups can also offer the type of problem-solving innovation that can help school leaders and teachers address students' learning needs. These innovations can range from finding ways to address math achievement gaps to removing time-consuming paperwork tasks from teachers' list of to-dos, so that teachers can focus their efforts on targeted teaching and lesson planning (Heussner, 2013; New Technology is Poised to Disrupt America's Schools, 2013).

Clearly, startups and schools have a great deal to offer one another through partnerships focused on creating innovative learning experiences for students. We believe well-designed games for learning can disrupt the status quo and help parents, families, and educators address the challenges of student engagement, perseverance, and personalized learning. They can also support teachers in meeting the challenges of providing real-time learning assessments, targeted feedback, and data-informed next steps for learning.

### CONCLUSION: GATEWAY TO LEARNING

So, perhaps games aren't a distraction—they're a gateway to learning for kids like Lucy, Vanida, and Seth. The potential for learning through digital game play shines bright. As technology continues to evolve, it just may be the learners who benefit most!

*“The potential for learning through game play shines bright. As technology continues to evolve, it just may be the learners who benefit most!”*

## APPENDIX A: RESOURCES FOR GAME SELECTION

The following resources can help you research and evaluate games for your learners:

### **Edshelf**

<https://edshelf.com/>

This resource offers reviews and ratings on popular educational technology products and games.

### **EdSurge**

<https://www.edsurge.com/products/>

This is a comprehensive, community-driven index to the most popular educational technology games.

### **Educade**

<http://educade.org/>

GameDesk, with funding and support from AT&T, created this online library of free lesson plans paired with learning tools.

### **Games and Learning**

<http://www.gamesandlearning.org/>

Through coverage of the market research and up-to-date analysis, Games and Learning reports on the opportunities and challenges facing those seeking to unlock the educational power of games.

### **Graphite**

<http://www.graphite.org/>

This is an index maintained by Common Sense Media where you can learn how games are rated and ranked by teachers and experts.

## ABOUT THE AUTHORS

### Gayle Allen

Gayle Allen is the Chief Learning Officer of BrightBytes and the Director of BrightBytes Labs. She has 15 years of experience as a teacher, school leader, and entrepreneur in the field of education. In addition, Gayle founded two professional development institutes for teachers and school leaders. She earned her Ed.D. from Teachers College, Columbia University, where she focused her research on teachers' experiences with web 2.0 technologies and where she also served as an adjunct professor. Most recently, Gayle earned her MBA from MIT's Sloan Fellows Program in Innovation and Global Leadership.

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Esteban Sosnik is the Executive Director of co.lab. Prior to joining co.lab, Esteban was co-founder and CEO of social game developer Atakama Labs (acquired by DeNA in 2011). After Atakama was acquired by DeNA, Esteban became VP with roles in studios, corporate development and alliances. Previously, he was co-founder and CEO of Wanako Games, developer of console games. Wanako earned Game of the Year for Xbox Live Arcade and was acquired by Vivendi Games in 2006. After Wanako's acquisition Esteban became VP of Business Development at Sierra Online. Previously, Esteban worked in venture capital, private equity and investment banking.

### Kristen Swanson

Kristen Swanson is a Senior Educational Technology Leader at BrightBytes. An educational leader and curriculum writer, Kristen is a renowned teacher, professional developer, writer, speaker, and consultant on impactful learning designs. She has worked directly under the tutelage of Dr. Grant Wiggins and authored both Professional Learning in the Digital Age (2013) and Teaching the Common Core Speaking and Listening Standards (2013). A founder of the Edcamp movement, Kristen is also passionate about effective teacher education. Kristen has a doctorate from Widener University in Educational Leadership.

### Cameron White

Cameron White is the Associate Director of co.lab. Previously, Cameron worked as a Fellow and Learning Technology Specialist at NewSchools Venture Fund. He has also worked at E.L. Haynes Public Charter School in Washington, DC, where he helped to align out-of-school programming with the school's broader missions. Cameron graduated with a B.A. in Architecture from Princeton University, where he wrote his undergraduate thesis on the intersection between child psychology and environmental design. He is currently a doctoral candidate at Columbia University's Teachers College, studying instructional technology and media.

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