

# {Kids:code}

## The Problem

In the next five years there will be more than 1.4 million computer-related job openings in the U.S., but only 0.4 million computer science graduates to fill these slots according to the U.S. Department of Labor. Right now less than 10% of schools in the U.S. offer computer science in their curriculum. If students are not introduced to computer science before college, then they will very rarely (~2%) pursue computer science majors in college according to a study performed by Google.

At current rates the U.S. educational system will fail to fill more than 70% of computer-related job openings with qualified applicants because children are not being introduced to computer science early enough. Many states are taking initiative by passing legislation that promotes teaching computer science in middle and elementary schools (2). Although a step in the right direction, many schools are falling short because they do not have enough qualified teachers for these programs. Some programs have resorted to teaching children Microsoft Word as part of their computer science curriculum because they simply do not have the resources to teach proper coding (3).

Children need to be introduced to computer science at a young age in a fun, educational, and inspiring way. Approximately 80% of students learn through visual and tactile learning styles, but currently there are limited resources that can teach computer science by this method (4).

## Our Innovation

KidsCode is a low-cost system designed for schools and organizations to teach, inspire, and develop computer programming skills in children through the use of physical objects that translate into machine code. KidsCode is the *first* educational programming experience that uses physical objects to teach computer programming. As an interactive board game KidsCode teaches children to think like a programmer and practice programming skills even without prior coding experience. We use a hands-on approach to allow students to start coding in the same way he or she would start tinkering with LEGOs. Students are able to gain a first look at programming through the easy-to-use game and software.

Featuring a dynamic, physical board that communicates with a nearby computer KidsCode creates an environment for problem solving through creative and strategic interactions. Rather than positioning a student to play against a computer or alone, KidsCode promotes learning through interactions with other students and teacher. Several players can play on the same board simultaneously promoting peer learning and growth.

The game has rules that are simple to understand and become more complex to adjust to the student's learning pace. Each game consists of two teams: the advancing team and the defending team. An advancing team must attempt to cross the map by placing tiles in strategic configurations. Each tile represents a portion of code that will run on the nearby computer. Different physical configurations will create different code structures. In this turn based game, the defending team must attempt to inhibit this movement by diverting the program with bugs by placing tiles that introduce obstacles for the advancing team. This forces students to problem solve by using logic that is critical to computer programming.

Students will be continually challenged as they develop their computer skills with KidsCode. As the students become more comfortable coding, more advanced features are introduced into the game increasing the difficulty level. These features range from simple tactile tasks to full use of popular computer languages. This allows students to develop their coding abilities without being initially overwhelmed with syntax or other daunting features commonly associated with other software.

For each piece added to the physical board a related segment of virtual code is consequently added to the student's machine. Each game piece teaches a specific programming structure or idea. For example if the advancing team adds an extension to a road it could create an IF statement, and the defending team could make the IF statement invalid preventing them from moving forward. This competitive back and forth game encourages students to better learn the "strategy" of computer programming without even looking at a single line of code in some cases.

By using radio frequency identification tags (RFID) in combination with hidden integrated circuits students' manipulations on the physical board game will be translated into programming code in a virtual world. For example when a game piece is added to the board, the computer will recognize the exact position, piece type, and configuration with the help of the hardware found in the board and game pieces. This allows the student to witness how problem solving techniques apply in a programmer's world.

The flexibility of KidsCode allows for all levels to compete and learn all aspects of computer science. KidsCode will provide expansion packs which teach new topics. In an expansion pack, at the edge of the game board the advancing team must infiltrate the defending team's castle. The castle represents a computer being attacked by malicious code. The defending team learns of methods to protect their castle while the advancing team tries to get in the mind of the defender and exploit holes in the opponent's logic.

Teachers will be able to facilitate student progress through the use of the teacher mediated interface even if they do not have any programming experience. The teacher mediated interface allows teachers to guide and challenge students to develop more advanced skills. Teachers can introduce new tiles and expansions at a pace that is right for their students' learning abilities.

KidsCode teaches children important computer-related and logic skills in an engaging way while giving teachers the tools to make computer programming an enjoyable learning experience for children.

## Our Customer

"Even where the importance of coding had been acknowledged, teachers had often not been given sufficient training and lacked confidence in their ability to deliver the curriculum."

- Forbes Magazine (6)

Teachers need tools that make it possible to teach computer science. For this reason, it is necessary to target individuals and organizations that would enable widespread adoption of our platform and computer science education in children. The need for new developmental strategies and the desire to encourage STEM (Science, Technology, Engineering, and Math) education is a necessary link between early adopters and the innovators. For this reason early adopters of our system will be elementary and middle schools with pre-existing computer science courses and electives. Since these courses are already offered our system will easily become part of the curriculum due to the need for quality teaching aids.

Additionally it will be important to target after-school programs, rec-centers, such as the YMCA, and other organizations that allow for children to explore and learn on their own time.

Parents have a vested interest in their children's education and gain from improved teaching methods making parents a primary stakeholder. Although purchasing our system for in home use would be possible, we have decided to mostly target organizations and schools since this will have the largest impact for the largest amount of children. Additionally, companies that need computer-related college graduates for business operations are long-run stakeholders. By introducing our youth to the coding environment, these companies are swaying students to pursue a future in the industry.

## Our Market

Schools and other organizations that offer or plan to offer computer-related courses need interactive, engaging, and creative resources to teach children. Since computer-related courses are extremely new there are fewer barriers to entry and school districts are actively seeking new resources.

Our competitors are other companies that offer similar learning opportunities for children, but these companies are predominantly online or have non-tactile learning activities. Kodable is one competitor that attempts to teach young children coding through the use of computer games. Kodable, however, does not have a physical board and only operates online thereby limiting learning opportunities for students, especially those that learn best through tactile learning. Kodable's failure to properly bridge the gap between the game and actual coding will prevent Kodable from seeing success in the market. Due to a lack of competition our product seeks to capitalize on inelastic demand rendering pricing obsolete.

The size of our market is limited to the number of schools that offer computer programming. Thankfully the amount of spending is increasing at approximately 5% each year of the \$7.9 billion that was spent in 2012 on teaching products (5). The current market is growing at a rate that is extremely easy for emerging technologies to exploit.

## Our Value Proposition

Children need to be introduced to computer science in a fun, educational, and inspiring way at a young age. Approximately 80% of students learn by visual and tactile learning, but currently there are no resources that can teach computer science by this method (4). KidsCode seeks to fill in this gap by providing students a chance to understand coding in new ways.

By drawing direct parallels between real world situations and computer programming children are able to learn programming efficiently. As the first physical teaching aid, KidsCode provides a better system for students to learn to solve problems in an active, fun, and collaborative setting. Active learning not only provides students with a greater understanding of topics, but it also results in students being more invested in their own education according to a study published in the American Educational Research Journal (1). Collaborative problem solving has been found to drastically improve learning outcomes in all situations, in a review of 90 years of research done by Johnson, Johnson and Smith (7).

KidsCode creates an environment for students and teachers to learn and teach in the best possible way. Our system positions students to have a future in science and an understanding of unique problem solving skills.

## Our Team

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