2. “Mathematizing Alice’s World” After completing the initial summer program, the students will be able to use Alice to create videos in which objects move about and interact in 3-dimensional space. Thus, they will have learned some of the structure of programming without the distraction of syntax. In “Mathematizing Alice’s World” they will engage in an after-school discovery-based experience that will be taught at area high schools, thus providing easy access for the students. Four separate sections (15-18 students per section) will meet once a week for three hours for 36 weeks.

In a typical three-hour experience the whole group will watch a fragment from an Alice video, preferably one made by the students in the previous summer. This particular video fragment will not involve rotations, but only translations in the picture plane (though this will not be stated). Breaking up into groups of four, the students will identify a specific simple motion in the Alice video and examine the mathematics behind it, so that they can duplicate it. The students will already understand from their Alice experience that the motion has duration and occurs in frames (steps). They will be encouraged to represent the steps visually from the beginning to the end of the motion, and evaluate if the motion is simple, repeated, or a compound motion (e.g., Does the transformation occur in a plane or in three dimensions?). The groups will reconvene to report on the simple planar motion their group has selected. Discussion will center on whether the selected motion is simple and planar, and in what plane it occurs.

The purpose of the program is to greatly increase the computer and linear algebra skills of area students. Students successfully completing the two-year program will be highly competitive for admittance into top computer science and math programs in the USA.

There are four target audiences. The experience will be led by faculty and students from the UAB computer science, mathematics, mathematics education, and engineering departments in collaboration with area high school teachers, parent facilitators, and community volunteers. The four target audiences are as follows:

1. Each year of the program recruits 50 9th grade students from the Birmingham City Schools and Bessemer City Schools. 98% of the students in these districts are minority and about 30% are from families living below the poverty line. The ALADDIN project seeks both outstanding math students and students that appear to have great potential but need further engagement. This population is greatly underrepresented in the IT, computer science and mathematics professions.

2. The parents of these students will learn about the promise of these careers and how to facilitate their child’s progress.

3. 12 teachers train each year as facilitators in one or more of the aspects of the program. These teachers transition to their classrooms the discovery-based teaching lessons they learn, and they thus are the foundation for sustainability of the program and for excellence in science and technology education at their schools.

4. UAB graduate/undergraduate students facilitate the various programs each year, thus greatly assisting the students, but more importantly, they become aggressive advocates for, and participants in, excellent K-12 science and technology education throughout their careers.

The programs have 5 parts:

1. The “Alice Film Festival” is a week-long summer camp that introduces over 60 students (four weeks with 15 students per week) to the world of computer visualization. Students will use Alice (www.alice.com) to design and implement simple movies and video games. From the very beginning, students will be asked to consider the notion of storytelling to construct their programs. In storytelling, the students describe the steps needed to bring about the animation within their program much like an animator or screenwriter constructs the scene of a cartoon or movie. This storytelling approach helps the students to reflect on desired behavior in an algorithmic manner that fosters analytic and logic skills development. Following the instructional sessions, each student will be given free time to explore a motivating case study that applies the knowledge learned in the module. For example, during the first day of interaction, students will build a simple movie involving an athlete kicking a ball that moves across the screen, or moving an ice-skater through a series of spins and jumps. This first movie will introduce much of the Alice environment and several programming constructs.

2. Students working on their Alice creations. During the school year, the students learn about the linear transformations that allow them to create three-dimensional action in a two-dimensional space.

3. “Robot Challenge” will be offered during the summer of the participants’ senior year. In this camp, an intense week-long 40-hour experience in advanced computing and research design. The four weekly sessions (up to 15-18 students in each session) follow a working knowledge of computer programming (e.g., in Java or C) that will further appreciate the 3-D object manipulation learned in both previous experiences. The inquiry-based experience focus will be mathematics-informed robotics projects that will build on previous knowledge of planar motion. Students will write robotics control software to perform some task in a spatio-temporal context, rather than just on-screen. For instance, they will manipulate position vectors to control the movement of a robot that pushes objects into a proper configuration within a specific time-frame. Students will be taught the computer science principles of embedded software control while providing additional experience in writing computer programs, a skillset they will need to exploit in their junior year mentored experience.