It’s Monday afternoon in Andy Stone’s fifth grade computer science class, and there isn’t a screen in sight. Student iPads are turned off and put away, and Stone tells the fifth graders to pair up for a paper-airplane-making exercise. The assignment involves constructing a paper airplane and then writing detailed instructions so that a partner can perfectly replicate it. The task emphasizes the importance of precision in giving instructions, one of the foundational concepts of computer science. Leave out a step, give directions out of order or use unclear terminology, and your paper airplane will not fly. It’s the same with programming: One tiny error in your syntax, and your code won’t run.

The point of this exercise is to ensure that the fifth graders are familiar and comfortable with the basic principles of computer science before they ever even think about actual programming.

Similarly, when computer science is introduced to Latin’s junior kindergarteners, it is completely unplugged. Instead, children play games, read stories and work with manipulatives and robots to gain an understanding of the concepts.

“We are teaching computer science so that students can understand what is happening rather than just giving them a set of tools,” said upper school computer science teacher GT Wrobel, whose room is often strewn with colorful LEGO’s and blocks and can look more like a lower school classroom than a computer lab.

Wrobel and Stone are part of the small team of information technology staff and faculty from various areas who have developed Latin’s new JK-12 computer science program. The mission behind their work is to provide the knowledge and skills that will allow students to understand and be prepared for the digital-based world they will encounter once they leave Latin.

Computer science requires logical reasoning, collaborative problem solving and critical thinking.”

— Shandor Simon, Director of Information Technology
Computer Science Thinking

To Shandor Simon, director of information technology and coordinator of the computer science initiative, introducing students to the depth and breadth of computer science is a critical distinction between simple computer literacy and fostering an entire mindset.

“Computer science requires logical reasoning, collaborative problem solving and critical thinking,” said Simon. These are far-reaching skills that are useful in understanding and navigating the world in general. They also provide a foundation for students to be able to “create and adapt new technologies rather than merely being skilled at working with existing technology,” which is likely to be outdated by the time they graduate.

He expects that computer science soon will be considered a core course of any liberal arts education, as important as English, math or science.

In many ways, creating a JK-12 computer science program is pioneering work. According to Forbes, only about 10 percent of K-12 schools currently teach computer science.

“Structuring a program at this level is sort of untrodden ground, at least when you compare it to established subjects where there is an understood sequence,” explained Wrobel, who also has worked with the nonprofit organization Code.org to write curriculum. “You are not working off a model. You have to try some things, see if they work and get feedback.”

A major challenge that the team has faced is fitting another subject into an already packed schedule. In the upper school, Wrobel offers a year-long Computer Science Principles elective. Wrobel surveys the class every week to find out what works and what doesn’t.

“We wanted to make it as attractive and accessible as possible, so that students would try it out,” he said. Another goal was to make the class inclusive, not tailored to students who are already interested in computer science or have an affinity for technology. Wrobel spends much of his time in class differentiating his teaching for students so that both the experienced and...
the novices can feel engaged. He also offers independent study opportunities for the truly passionate.

This year, 20 students signed up for the course. They started the year off by doing experiential hands-on work to develop a mental framework on which to build. As the class has moved on to programming, the approach has remained accessible and visual rather than getting mired in numeric and text inputs and outputs. One recent assignment was to create a drawing application that included manipulating RGB web colors, which inspired one student to translate his work into an art project that he later exhibited.

In 2015-16, Wrobel will expand Computer Science Principles into a sequence of two one-semester courses, and will add courses in Web Application Development and Advanced Programming, which will continue to be offered as electives.

In the middle school, Andy Stone currently teaches computer science to the fifth and eighth grades once every eight days – not an easy fit because of the already full middle school schedule.

“In some of my students have no experience in computer science and no interest in learning about it,” Stone said. His role, he said, is to show those students that no matter what their interest, computer science can enrich it. “I see it as an opportunity to bring kids on board who might otherwise never realize how applicable it is.”

His goal for the coming year, working with the new middle and lower school computer science teacher, is to find subject areas at each grade level in which an interdisciplinary approach that includes computer science learning is appropriate. By including computer science in subjects with which students are already familiar, Stone hopes to illustrate how essential an understanding of it has become to a variety of fields.

In her first grade classroom, teacher Fiona Deeney regularly schedules a section called maker/innovation time. It is a period when students are encouraged to build, innovate, collaborate and problem-solve. Recently, some children were creating a track for a Sphero robot ball that they synced to an iPad app. In another part of the room, students were tinkering with circuits attached to a laptop to make music, while others were constructing a dwelling with a Goldieblox set. Without really knowing it, the first graders were learning and reinforcing the basics of computer science.
Age Matters

To those looking at the future of computer science at Latin, however, the lower school is at the heart of where the program is headed over the next decade. “From the time they are in JK, our students are learning the language and ideas of computer science,” said Simon. “By the time they reach middle and upper school, they will already have the strong foundation that we are currently spending class time on.”

In the coming years, Simon sees the course offerings in the upper school looking more like the choices students have in other subjects in terms of their number and variety. He also hopes that making computer science part of every student’s experience from a young age will organically diversify the field to include more women and minorities, who traditionally have not pursued computer and tech degrees or careers.

Sitting in her office surrounded by games, robots and iPads, Lower School Technology Coordinator Chris Eustice wants to make computer science fun and dynamic. She is always researching new apps and activities that can be incorporated into the curriculum. The junior kindergarten class uses Bee Bots, miniature robots that look like bees and can be programmed to follow commands; reads Little Mouse Gets Ready by Jeff Smith to discuss what an algorithm is; and plays games such as Programmer Says, a version of Simon Says. In senior kindergarten, students still spend much time with hands-on activities but also are introduced to computer skills and begin learning the Code.org K-5 curriculum that is the backbone of the lower school program. In fourth grade, Eustice teaches Scratch, an MIT-designed program that introduces coding through a simple drag-and-drop interface called block coding. She also uses the Scratch-based Creative Computing curriculum, which allows for more project-based learning, and she has been working with teachers to find opportunities for students to use their coding skills. Recently, she collaborated with the fourth grade teachers to make a coding assignment part of the unit on Ancient Egypt. Students were asked to recreate a chapter of a book using coding. They could make a story, create an interactive game or build something illustrating the chapter.

Next year, Eustice wants to have every fourth grader complete a curricular project using code. She also plans to provide more opportunities for older students to reinforce their knowledge and skills by teaching younger students.

“There are some kids who learn the basics of coding and then take it and run with it,” said Eustice. She has witnessed students develop games and programs that are both creative and sophisticated in her morning Coding Club. Because of the newness of the curriculum, she admits that she often learns alongside the students and sometimes is outpaced by them. “I’ve come to accept that I won’t always be the expert,” she said. Instead, she sees both students and teachers benefiting from a collaborative learning partnership.

For the computer science team, it is an exciting time. They are covering new ground that will allow Latin students not only to be successful in the digital world but also to become innovative critical thinkers.

“There are some kids who learn the basics of coding and then take it and run with it.”
– Chris Eustice,
Lower School Technology Coordinator

By teaching students computer science, we are giving them one more way to understand how the world works,” said Simon. Just as Latin does with any other subject, the school is providing a strong foundation of skills and knowledge, offering opportunities and supporting students as they go on to shape the future.

Computer science learning through LEGO in the upper school.