# Improving Undergraduate Retention through Tailored Use of the Infinity Project℠

**Daniel Waters, Armando Mora, Lizette Zounon, J. Carter Matheney Tiernan**

Computer Science and Engineering Department
University of Texas at Arlington

## Abstract

This paper addresses the issue of using the proven Infinity Project℠ program as a foundation to build computer science and engineering students' knowledge of software as well as hardware and to create an expectation of what they may be able to achieve in the future. The Infinity Project is a nationally recognized partnership between leading research universities, industry, government, and educators that has created innovative educational approaches to modern engineering that are both fundamental and fun.[1] The development of the Infinity Project material was spearheaded by the Electrical Engineering (EE) faculty at SMU along with engineers at Texas Instruments (TI), makers of the DSP components used in the Infinity VAB kit, and Hyperception, Inc., the software developers for the VAB software to control the DSP. The Infinity Project is designed around hands-on experiments that demonstrate the basic concepts of electrical engineering. Each experiment utilizes real-time DSP hardware in the Infinity Technology Kit controlled with the Visual Application Builder (VAB™) component-based DSP software that provides a graphical interface and a methodology of developing DSP systems by simply connecting functional block components together with point-and-click methods.

This paper focuses on how the Computer Science and Engineering Department (CSE) at UTA is tailoring the use of the Infinity Project to the needs of a computer science audience. In particular, we will discuss how CSE@UTA will use the structure of the Infinity Project to not only let incoming freshmen CSE majors explore the interesting and hands-on engineering applications made possible by the use of the DSP and other components but to also integrate these activities with explorations of programming.

## Introduction

The University of Texas at Arlington is implementing the Infinity Project℠[2] in its Computer Science and Engineering (CSE@UTA) Department as one facet of a broad approach to improving retention of students in the CSE majors. This paper addresses the issue of tailoring the Infinity Project's use to the needs of a computer science audience.

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The Infinity Project is a nationally recognized partnership between leading research universities, industry, government, and educators that has created innovative educational approaches to modern engineering that are both fundamental and fun. ("Overview of the Infinity Project", http://www.infinity-project.org/home.html) The development of the Infinity Project material was spearheaded by the Electrical Engineering (EE) faculty at SMU along with engineers at Texas Instruments (TI), makers of the DSP components used in the Infinity VAB kit, and Hyperception, Inc., the software developers for the VAB software to control the DSP. The Infinity Project is designed around hands-on experiments that demonstrate the basic concepts of electrical engineering. Each experiment utilizes real-time DSP hardware in the Infinity Technology Kit controlled with the Visual Application Builder (VAB™) component-based DSP software that provides a graphical interface and a methodology of developing DSP systems by simply connecting functional block components together with point-and-click methods. The project developers from SMU, TI and Hyperception, Inc. have described the Infinity Project as a method to allow students to "create real-time DSP implementations and experience an incredibly efficient means of graphical programming – without having to write any source code at all!"[3]

This paper will discuss how CSE@UTA will use the structure of the Infinity Project to not only let incoming freshmen CSE majors explore the interesting and hands-on engineering applications made possible by the use of the DSP and other components but to also integrate these activities with explorations of programming. One interesting aspect of this implementation is that while the Infinity Project's approach to the software is "Imagine – actually programming a DSP without having to use C or assembly language,"[4] our goal for the implementation of the Infinity Project in CSE@UTA is for students to gain an appreciation for effect of "invisible" software on the physical world. By using the proven Infinity Project program as a foundation, we can build students' knowledge of software and create an expectation of what they may be able to achieve in the future. For students using and enjoying their experience with the Infinity Project, the goal is not to create code but to create the desire to create code.

## Rationale

As with many other engineering disciplines, computer science has the quality of being "a lot harder than it looks" to many incoming students. Thus, retaining students in computer science and engineering majors is an on-going concern. Further, fewer students in the major means fewer graduates in the discipline and fewer qualified citizens to be employed in critical technical areas. In Texas, the high technology industries, though suffering just now from the economic downturn, in general cannot find enough local engineering graduates to fill their needs. This is even more acute in those industries which may have sensitive national security functions and which thus are not open to international graduates from Texas universities. To address this issue, the state of Texas provided funding for universities to use to improve the retention of students in the engineering and computer sciences. The Computer Science and Engineering Department of the University of Texas at Arlington (CSE@UTA) has chosen to implement the Infinity Project[5] in its freshman introductory computer science course as one effort to improve its student retention rates under this state-funded program.


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The Infinity Project was initially designed to target high school upperclassmen and has been used with good results in freshman electrical engineering courses at Southern Methodist University. This program provides entering university students with hands-on access to real-time hardware[6] and dynamic manipulation of that hardware through a graphical interface[7]. The Infinity Project has a series of lab assignments, which include content information, an experimental framework with a set of questions, and a hardware/ graphical interface experiment or experiments.

For CSE@UTA there are a number of advantages to implementing Infinity. First and foremost, it is fun! The experiments are informative and entertaining so students enjoy the time they spend with this set-up. Second, for CSE students this is early exposure to a real-world application of the practice of software that they are beginning. Third, in our particular case, it is useful that the developers of the Infinity Project are in Dallas, a scant 20-minute drive from our campus. This is a benefit that we will be taking greater advantage of during the upcoming semester.

However, there is a distinct disadvantage in using the Infinity Project with students who are software-focused in their academic career. This disadvantage is that the designers of Infinity went to some pains to HIDE the software such that an Infinity user could manipulate the hardware in a large variety of ways without ever having to see any code. For the electrical engineers, this met their education goals for Infinity. For computer science majors, it leaves a gap between the discipline of study and the tool that they are using.

## Pedagogical Approach

In order to overcome this particular limitation of the program, the implementation of the Infinity Project in the Computer Science and Engineering Department of the University of Texas at Arlington (CSE@UTA) is being tailored to add a component which will make visible the hidden software and use it to initiate new students into the power and creativity of software. The approach we will use is a variation on the idea of teaching programming through software "literacy,"[8] in our case, through guided viewing of the code of some of the graphical modules.

There are three elements of this guided viewing approach. First, as a student begins a lab, the tailored lab will have a link for the student to see the code of one of the modules, which will be part of the upcoming experiment. The visible software will be annotated or highlighted to focus on some particular construct, which will be discussed in the lab text. This will provide an introduction to that programming structure. The second element in this approach is then to have the student execute the experiment and "make something happen" with the hardware. The lab text will then help the student make connections between the code they saw and the effect that was created in the hardware. The third part to this approach is to also have variations on this experiment in which the software module that was examined before is now modified. The student has a chance to see the changed code, predict the changed effect, and then, when the experiment is run with this new module, see if their prediction is true. This develops the students' internalization of the use and meaning of the software constructs.


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This three-part approach to making the software of Infinity visible is currently in development here at UTA. We have begun discussions with the engineers at Hyperception, Inc. to get their input and assistance in either providing code for existing modules or assisting our team to create their own modules. We are also in the design stage of creating the software-focused labs that will aid the students in becoming literate with software and developing their understanding and their intuition about what software can do.

## Summary

Our goal for the implementation of the Infinity Project in CSE@UTA is for students to gain an appreciation for effect of "invisible" software on the physical world. By using the proven Infinity Project program as a foundation, we can build students' knowledge of software and create an expectation of what they may be able to achieve in the future. For students using and enjoying their experience with the Infinity Project, the goal is not to create code but to create the desire to create code.

## References


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ARMANDO MORA

Armando Mora is an undergraduate research assistant for the Infinity Project implementation in the Computer Science and Engineering Department (CSE) at the University of Texas at Arlington (UTA). He is a junior pursuing a CSE degree.

DANIEL WATERS

Daniel Waters is a junior pursuing a CSE degree and an undergraduate research assistant for the Infinity Project implementation in CSE at UTA. He is also currently a software designer for K Solutions, Inc. and has published several articles on ASP and other topics.




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LIZETTE ZOUNON
Lizette Zounon is an undergraduate research assistant for the Infinity Project implementation in the Computer Science and Engineering Department (CSE) at the University of Texas at Arlington (UTA). She is a junior pursuing a CSE degree and also works in the University Math Clinic as a tutor.

J. CARTER MATHENEY TIERNAN
Dr. Tiernan is a Lecturer, an Undergraduate Advisor, and the CSE Director of Outreach in the Computer Science and Engineering Department (CSE) at the University of Texas at Arlington (UTA). She is the Principal Investigator for the implementation of the Infinity Project in CSE at UTA. Her areas of interest include engineering pedagogy, artificial intelligence, and software engineering. Dr. Tiernan previously worked as a software design engineer for Texas Instruments and as a Coordinator and National Liaison for Project SEED, a national mathematics teaching organization.


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