Abstract - This paper addresses two main problems in two different domains by integrating them into one interdisciplinary project. Software engineering graduates lack the necessary skills and experience required by employers to address real-world problems. Students enrolled in organic chemistry course often struggle with the content due to its visual nature and its requirement for several learning skills (visual, logical, mechanical). To address these two seemingly non-related educational issues, the investigators in this project have devised a “business” relationship between the students in an upper-level software engineering course and the students in an organic chemistry course. The software engineering students have been “hired” to design and develop a mobile application to help tutor and teach the organic chemistry concept of “functional groups” by involving multiple avenues of learning. By enabling this business relationship we attempt to provide the software engineering students with authentic experiences involved in developing software and to provide organic chemistry students with a tool that helps them learn fundamental concepts in organic chemistry.

Index Terms – collaboration, group projects, interdisciplinary, software engineering.

BACKGROUND AND CONTRIBUTIONS

Much research has been done on the gap between software engineering graduates and employers’ needs [1]-[6]. The difference between professional environment and academic environment does not prepare students adequately for their jobs. Graduates take up to 6 months before they make any useful contributions to the project [7]. As suggested by many, the problems are not really technical. A study conducted at Microsoft Corp. showed that coding, design, persistence and problem solving were the strengths of the graduates, while communication, collaboration, technical (in terms of using tools like revision control system), cognition and orientation were their limitations [8]. The graduates in this study also had problems working with pre-existing codebase that lacked documentation (both in quantity and quality).

The Real World Lab at Georgia Tech provides commercial projects to students that span from 6 months to 2 years. Students start at entry level and can get promoted up to project manager level [9]. But providing such industry experience may not be possible for many universities. The students can also get real world experience through internship courses. But this important experience usually comes at the end of students’ course of study. Through our project we aim to provide this relevant experience to our students much earlier in their course of study. Using group-based projects to emulate real world environment is a popular approach [1], [10]-[12]. But many times vague instructions provided by the instructor may lead the students to interpret and develop the project according to their understanding. If such projects are then graded based on demonstrations and presentations then it prevents the students from getting any meaningful experience with all stages of the development life-cycle [10], especially so in a one-semester course. Other techniques have also been tried. Disrupting class’ software development process using 20 “dirty tricks” to give them a real-world experience [11], changing teams mid-way during the semester to emulate constant changes in the development environment [12], giving the students an experience of working in a large team by forming a single team of the entire class and requiring students to interview for desired positions on the team [1] are some such techniques.

These different approaches focus on various areas that need attention in software engineering education. The primary focus of our project is to provide the students an opportunity to develop their communication and collaboration skills, requirements elicitation skills, to make them aware of realities of the workplace such as changing requirements and changing technology. Some of the ways in which we plan to achieve these goals are by providing the students with a real problem that is outside their domain knowledge, by involving the client (organic chemistry instructor) in the requirements gathering, analysis and prototyping phases and requiring the end users (organic chemistry students) to beta-test the end product towards the end of the semester. The end product can be used by Software Testing and Quality Assurance course as a case study in future and the feedback gathered from the end-users can be used in future offerings of the software engineering course to enhance the product. This will give the students enrolled in future sections a pre-existing codebase and documentation to work with and thus addresses the issues raised in [8] and [11]. Asking software engineering students to address a problem in a domain outside of their area of
expertise and develop a solution for their peers makes this project novel and potentially valuable, as it may provide insight into a critical aspect of course and curriculum design – transferability and authenticity of the projects assigned in software engineering courses. This project is not just an emulation of a real project, but rather it is a real project that requires a working solution within identified and specified constraints.

The issue of changing technology [6] is addressed slightly differently in this project. Although none of the technology changes during the project development, the students have to work with an unfamiliar technology. These students have previously learned programming in Java and have used Eclipse for development. Since they are now required to create an iPhone application, they have to familiarize themselves with Objective-C, Xcode and Interface Builder.

This project also contributes to science education research. The mobile application will be used by organic chemistry students and their feedback on the effectiveness of this application to learning organic chemistry concepts will give us an idea of how effectively we can use technology to engage our students outside the classroom. Hence the successful completion of this project within the specified framework is essential to both the groups: software development students and instructor and organic chemistry students and instructor.

CURRENT STATUS AND FUTURE PLANS
Currently, this project has been assigned to students and so far they have had continuous interaction and story boarding sessions with the client to gather requirements. Some technical steps that do not require client interaction, but require peer-reviews and walkthroughs have been conducted. The students have also demonstrated their prototype to the client for approval. Towards the end of the semester the product will be beta-tested by the end-users (organic chemistry students).

For assessment purposes, we plan on conducting interviews and administering surveys to:

- Determine any changes in attitude towards students’ native and partner discipline
- Gather student feedback about the interdisciplinary experiences of the project
- Gather student feedback about experiences with the peer partnership

Permission for interviewing and surveying the students was obtained from the institution’s IRB committee. A pre-quiz was administered at the beginning of the semester in both classes and a post quiz will be administered at the end of the semester to determine changes in the students’ domain knowledge. The pre-quiz certainly shows lack in domain knowledge that we expect to improve significantly by the end of the semester. Our initial interviews with the students demonstrate a focus on coding and completing the project without wanting to put significant amount of time on documentation. The initial interviews revealed that the focus is on technology and not so much on the process. We are now planning on conducting interviews after the students have gone through the process of gathering requirements and demonstrated a prototype to determine the changes in their attitude as they move through the construction phase of their project. We also plan on interviewing our current software engineering students in future when they are gainfully employed to gather their feedback about the usefulness and relevance of this experience at their work place.

CONCLUSION
Through this interdisciplinary project we aim to provide an authentic experience to our software development students earlier in their course of study by providing them with a real project for in-house development instead of just emulating the software development process and environment. We hope to see a shift in attitude towards software engineering and a realization that the process is as important as the technology for the successful completion of a project.

REFERENCES