CSIT XXX – Applied Programming for All Majors: A Contextualized Course Based on Inter-Disciplinary Curriculum Development

Pamela Bogdan
Engineering & Technology Dept
Ocean County College
Toms River, USA
pbogdan@ocean.edu

Sylvia Riviello, Phd
School of STEM
Ocean County College
Toms River, USA
sriviello@ocean.edu

***Abstract*— This abstract of a Work In Progress for the Innovative Practice Category will describe both the need and design of a contextualized applied programming for all majors course that is based on inter-disciplinary curriculum development. Contextual teaching centers around improving the learning experience by linking it to the real world and the students career goals and academic major. Successfully doing that in the setting of a general education classroom is one of the challenges that is addressed by this course. It is anticipated that this approach can and will be used for other general STEM disciplines. This framework for course creation can make STEM courses more appealing to a larger population because they will understand through contextualized assignment how the material relates to their world. By creating an applied programming course for all majors, this initiative fills a common gap in general technology education. Many times, these courses fall into two basic categories: general computer literacy and programming for computer science majors. This course addresses general programming literacy for those students that will use programming as a tool, but not make programming their full-time job. It is envisioned that students enrolled in the same course and the same section would be presented the same basic programming concepts and then exercise them with problems designed specifically for their field of study. It is expected that this will lead a larger number of our students to acquire and understand the value of basic programming skills. This better appreciation for programming should help them in their future careers as they might do some programming and/or work with software and software developers. The enriched learning experience is achieved because major-specific assignments are jointly developed with all schools across the institution. This tight linkage allows for the applied-assignment portion of the course to pull through the expertise of faculty that is more well equipped to create real world assignments that show how their field of study utilizes computers and programming.**

Keywords—contextualized learning, innovative practice

I. INTRODUCTION

As educators, it is our goal to both present information and have our students progress through all of the phases of Bloom's taxonomy in order to fully benefit from our their educational experience. In other words, we want them to achieve all six levels of cognitive objective from Bloom's revised taxonomy – remembering, understanding, applying, analyzing, evaluating and creating". [1] All of this starts with actually listening to the information. So how do we motivate our students to be receptive to the learnings that they can derive from a course. Our solution is to contextualize the learnings.[2],[3],[4],[5]

> "Contextual teaching and learning involves making learning meaningful to students by connecting to the real world……. Some examples of contextual teaching and learning are interdisciplinary activities across content areas…"[2]

In a world that runs a warp speed, students understand that time is a precious commodity and they immediately size up any experience to determine if it worth investment of their time and emotional and physical energy. Contextualized courses allow us to pass that assessment by our students and more fully engage them in the learning process.

If contextualized learning is then combined with adaptive learning so that the course is both meaningful and customized for efficiency, then as Figure 1 below shows, we have hit the proverbial bullseye for educational experiences.[6] [7]

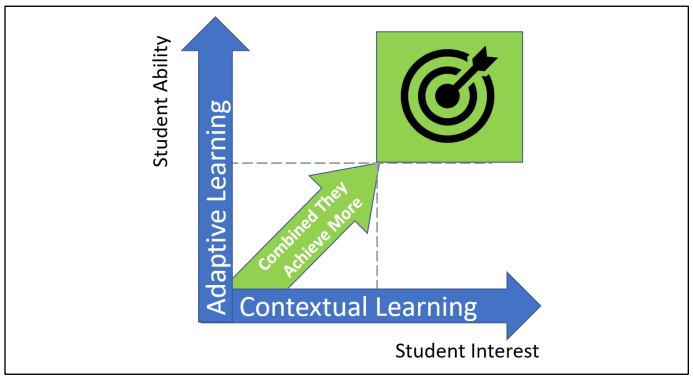

Fig 1. Combining Adaptive Learning With Contextualized Learning

Adaptive learning, optimizes the education experience to align with a student's ability and prior knowledge to address motivation from a different angle. As written in [6],
"The goal of adaptive e-learning is aligned with exemplary instruction: delivering the right content, to the right person, at

the proper time, in the most appropriate way—any time, any place, any path, any pace…..”

Any topic with natural connectedness to an e-learning environment, such as programming, should be able to take advantage of both dimensions: contextualized learning and adaptive learning. At the time of the writing of this work in progress paper, we will only address our implementation of contextualized learning within a general education course.

II. The Driving Needs for CSIT XXX

At Ocean County College, as with most schools across the country mandates to decrease the number of program credits have caused us to make some tough decisions. We have all had to design and implement academic programs that are streamlined and yet still meet the needs of our students as we prepare them for their future careers. This has put a strain on both the program-specific courses and the general education courses. This new course CSIT XXX attempts to address the gap that we had seen in the area of General Technology education, aka computer literacy and entry to software programming degree programs.

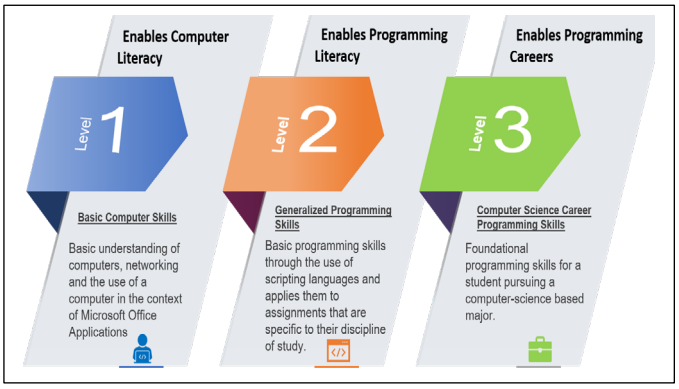

Fig 2. Three Levels of General Technology Education Courses

We had both ends of the spectrum of preparing students for life in a digital age, but nothing in between. The computer literacy courses teach the basics of using a personal computer and the programming courses are C++ and Java. For those students that needed programming skills, but did not need the more sophisticated intracacies of languages like C++ or JAVA there was no general education option. For engineering students, they did have a course within their program, that included learning outcomes addressing the basics of programming and applying them in the context of engineering problem solving (ENGR 124 Engineering Analysis (i.e. MATLAB)). As this implies, this example set of students had to take two programming courses. The first in a language most would probably never use and second with a language that most likely they could utilize in their professional life. In working to streamline the AS Engineering program we developed a course of general utility for a broader spectrum of students. Our target student for the CSIT XXX course are both STEM and non-STEM students that need programming literacy. For these students the ability to do basic programming is an enabler for success in their chosen career, but not the main focus. CSIT XXX would be considered a Level 2 general education technology course, as described in Fig 2.

I. The Vision of CSIT XXX

At Ocean County College, we have a long history of inter-disciplinary cooperation and joint programs across the various schools. Having that type of culture within the faculty and administration is a key enabler to this type of curriculum development and delivery. As is seen in Fig 3, it takes active involvement from all schools that will guide their students to this course in order to create and maintain content.

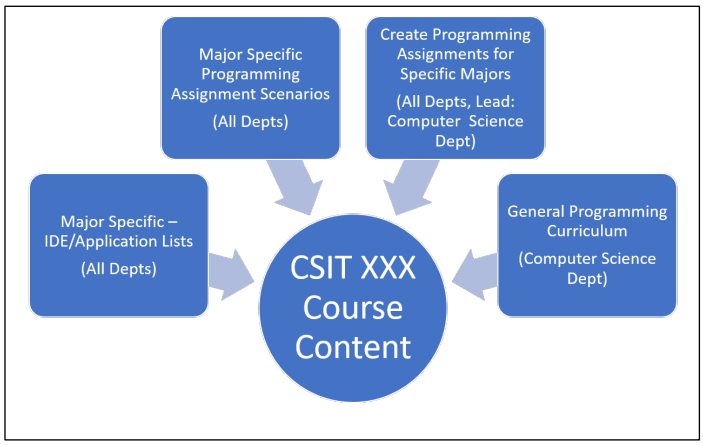

Fig 3. Course Content Creation Model

In this model the computer science, or technology, faculty lead the effort with their overall guidance and oversight for the learning objectives. These learning objectives align with the goal of the course to teach programming literacy and would align with the general education objectives for all programs that include this course as an option. The lead faculty would also be responsible for the creation of the materials that introduce the students to the general programming concepts that they will later exercise with contextualized programming assignments. The initial vision for those learning outcomes are listed below. In the next section you will see how they have evolved with the first implementation of CSIT XXX known as CSIT 124 Introduction to Programming.

CSIT XXX – Learning Outcomes

- Create an algorithm for a specific problem.
- Create a flowchart from the algorithm.
- Use software programming constructs and functionality to convert the flowchart into a written program or script to achieve goals of discipline-specific assignments.
- Use software testing and troubleshooting techniques.
- Present results of analysis both numerically and graphically.

Faculty members from other disciplines will work with computer programming assignments. The lead faculty would be responsible to ensure consistency across the various discipline-aligned assignments. Although each student is learning about topics such as data visualization, the engineering student might analyze real world data sets that were collected as test results of a new design while the arts & humanities student could use these techniques to create visual art and finally the business student could present financial information. Each student experiences how these skills can be applied in their future profession.

II. The Initial Version of CSIT XXX

The initial version of CSIT XXX at Ocean County College is CSIT 124 Introduction to Programming. The following is the Fall 2021 OCC course catalog description for CSIT 124 – Introduction to Programming.

"This course addresses general programming concepts appropriate for all students (both non-STEM and STEM), who will use programming as a tool within their career field. Students are presented basic programming concepts and then exercise them with contextualized real-world problems. The application of programming theory will be done using computational programs such as Python and MatLab."

As the official course description was finalized, the learning outcomes evolved to achieve more consistency with our level 3 Gen Tech courses. This alignment makes sense, since our goal is still to teach programming with the added bonus of contextualizing it so that it will hopefully enable a wider breadth of students to gain basic programming skills. The following list shows the mapping between CSIT XXX learning outcomes and CSIT 124 learning outcomes.

CSIT XXX Learning Outcomes with CSIT 124 Learning Outcomes Mapped As Sub-bullets.

- Create an algorithm for a specific problem.
  - Identify the steps required in problem solving.
- Create a flowchart from the algorithm.
  - Describe the properties of an algorithm in order to differentiate between an algorithm and a computer program.
- Use software programming constructs and functionality to convert the flowchart into a written program or script to achieve goals of discipline-specific assignments.
  - Write programs that use conditional control and repetition structures and functions.
  - Construct and manipulate arrays.
  - Generate programs to analyze data and present results in the context of real-world problems.
- Use software testing and troubleshooting techniques.
  - Design, code, test and debug simple programs and functions.
- Present results of analysis both numerically and graphically.
  - Generate programs to analyze data and present results in the context of real-world problems.

Our target is to offer this course for the first time in Spring of 2022. A rudimentary measure of success would be the shift of students in the supported majors from the other course options (Level 1 & Level 3) towards taking this course, with special emphasis of looking at students that chose to take the level 2 course (CSIT 124) instead of the level 1 course.

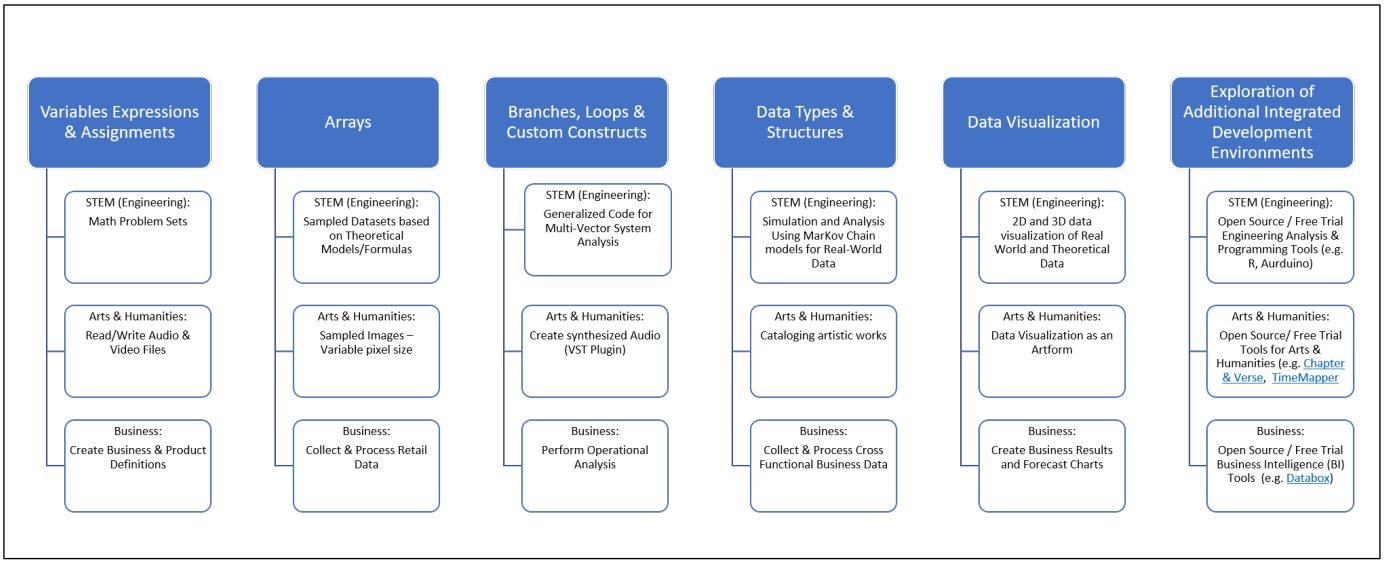

Fig 4. Examples of Contextualized Programming Assignments.

III. Spreading the CSIT XXX Contextualized Learning Model to Other Curriculum

At the time of writing this paper we are currently considering the following courses to implement the CSIT XXX contextualize model of discipline-specific assignments:

- MATH 156 – Introduction to Statistics
- Math 158 – Algebraic Modeling

A more traditional model for contextualized courses is to create contextualized courses or unique versions of courses from a specific student group, with a common core. The following are examples that exist at OCC.

- STSC 160 – Student Success Seminar for Engineering Majors
- STSC 170 – Student Success Seminar for Business Majors
- STSC 171 – Student Success Seminar for the Helping Professions

This model works well when the volume of student enrollments can justify unique courses or the contextualization components are both application and instructional content in nature. For the CSIT XXX model, students from different backgrounds and interests can both apply and see that the core theory has a wide set of applications as they interact with students in other fields of study in the same classroom.

IV. Summary

It is expected that this work in progress, known as CSIT XXX, will address the need for a general education basic programming course for non-computer science students and lay the foundation for a contextualized curriculum creation and delivery model that can be used for a breadth of subjects. Because CSIT XXX is a general education course, the learning objectives of this course will align with each program as it pertains to the required general education curriculum. As with any Gen Ed course, it benefits from scheduling efficiencies due to a single course meeting the needs of a breadth of students from various disciplines. This course will act as an example for future multi-discipline curriculum develops. The model, in this case, leverages the core knowledge and oversight of assignment consistency from the computer science department and combines that with the other departments' knowledge of application usage. Most importantly it is anticipated that it will increase the motivation of students through all phases of the learning process[1] and potentially encourage more students to nurture computer skills.

Acknowledgment

The authors would like to acknowledge the contributions of Prof. Gerald Cohen and Prof. Ken Michalek for their partnership in the creation of the initial version of CSIT 124.

References

[1] "Revised Bloom's Taxonomy Action Verbs", Anderson,L.W., & Krathwohl,D.R.(2001).A taxonomy for learning, teaching,and assessing, Abridged Edition. Boston, MA: Allyn and Bacon. https://www.apu.edu/live_data/files/333/blooms_taxonomy_action_verbs.pdf

[2] CONTEXTUAL TEACHING AND LEARNING: WHAT IS IT? https://www.asec.purdue.edu/lct/hbcu/documents/ContextualTeachingandLearning.pdf

[3] Dolores Perin. "Facilitating Student Learning Through Contextualization: A Review of Evidence." Community College Review. July 25, 2011.

[4] The Effect of English Classroom Tasks In Contextualized and Localized on Students' Performance. Ida Nuraida and Sisca Wulansari 2019 J. Phys.: Conf. Ser. 1179 012077.

[5] Kalchik, Stephanie & Oertle, Kathleen. (2010). The Theory and Application of Contextualized Teaching and Learning in Relation to Programs of Study and Career Pathways. Transition Highlights. Issue 2. Office of Community College Research and Leadership.

[6] Valerie Shute, Brendon Towle, Lajoie, S.P., & Kyllonen, P.C. (Eds.). (2003). Aptitude: A Special Issue of Educational Psychologist (Adaptive E-Learning Chapter) (1st ed.). Routledge. https://doi.org/10.4324/9780203764664

[7] Oxman, Steven, William Wong, and D. Innovations. "White paper: Adaptive learning systems." Integrated Education Solutions (2014): 6-7.